2016
PROBABILISTIC MONITORING WORK PLAN FOR THE LOWER WABASH RIVER BASIN

PREPARED BY

Paul D. McMurray, Jr.
Probabilistic Monitoring Section

and

Kristen Arnold
Targeted Monitoring Section

WATERSHED ASSESSMENT and PLANNING BRANCH (WAPB)
Indiana Department of Environmental Management (IDEM)
Office of Water Quality
100 North Senate Avenue
MC65-40-2 Shadeland
Indianapolis, Indiana 46204-2251

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SIGNATURE PAGE

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Indiana Department of Environmental Management
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Author(s) Signatures

Paul McMurray _____ Date 6/15/16

Kristen Arnold _____ Date 6/15/16

Tim Fields _____ Date 6/16/16

Management Reviews and Approvals

_____ Date 6/15/16
Stacey Sobat, Section Chief Probabilistic Monitoring Section
IDEM Watershed Assessment and Planning Branch

_____ Date 6/15/16
Cyndi Wagner, Section Chief Targeted Monitoring Section
IDEM Watershed Assessment and Planning Branch

_____ Date 6/16/16
Timothy Bowren, Project Quality Assurance Officer, Technical and Logistical Services Section
IDEM Watershed Assessment and Planning Branch

_____ Date 6/17/16
Mike Sutton, Section Chief Technical and Logistical Services Section, Quality Assurance Manager
IDEM Watershed Assessment and Planning Branch

_____ Date 6-15-16
Marylou Renshaw, Branch Chief, Branch Quality Assurance Coordinator
IDEM Watershed Assessment and Planning Branch

IDEM QA staff reviewed and approves this Sampling and Analysis Workplan.

Michael L. Spinar Date 6/23/16

Quality Assurance Staff
IDEM Office of Program Support

WORK PLAN ORGANIZATION

This Sampling and Analysis Work Plan is an extension of the existing Watershed Assessment and Planning Branch, October 2004 "*Quality Assurance Project Plan (QAPP) for Indiana Surface Water Quality Monitoring and Total Maximum Daily Load (TMDL) Program*" and serves as a link to the existing QAPP as well as an independent QAPP of the project. Per the United States Environmental Protection Agency (U.S. EPA) 2006 QAPP guidance (U.S. EPA 2006), this Work Plan establishes criteria and specifications pertaining to a specific water quality monitoring project that are usually described in the following four groups (phases) or sections as QAPP elements:

Section I. Project Management/Planning

- Project Objective
- Project/Task Organization and Schedule
- Background and Project/Task Description
- Data Quality Objectives (DQOs)
- Training and Staffing Requirements

Section II. Measurement/Data Acquisition

- Sampling Procedures
- Analytical Methods
- Sample and Data Acquisition Requirements
- Quality Control (QC) Measures Specific to the Project

Section III. Assessment/Oversight

- External and Internal Checks
- Audits
- Data Quality Assessments (DQAs)
- Quality Assurance/Quality Control (QA/QC) Review Reports

Section IV. Data Validation and Usability

- Data Handling and associated QA/QC activities
- QA/QC Review Reports

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LIST OF ACRONYMS

AIMS: Assessment Information Management System
ALUS: Aquatic Life Use Support
ASTM: American Society for Testing and Materials
AU: Assessment Unit
CAC: Chronic Aquatic Criterion
CALM: Consolidated Assessment Listing Methodology
CFR: Code of Federal Regulations
CFU: Colony Forming Unit
CPR: Cardio-Pulmonary Resuscitation
CRO: Community Relations Office
CWA: Clean Water Act
DELT: Deformity, Eroded Fin, Lesion, Tumor
DIC: Differential Interference Contrast (Microscope)
DNR: Department of Natural Resources
DQA: Data Quality Assessment
DQO: Data Quality Objective
E. coli: *Escherichia coli*
EMAP: Environmental Monitoring Assessment Program (http://www.epa.gov/emap/)
GPP: Generator Powered Pulsator
GPS: Global Positioning System
HDPE: High-density Polyethylene
HUC: Hydrologic Unit Code
IAC: Indiana Administrative Code
IBI: Index of Biotic Integrity
IC: Indiana Code
IDEM: Indiana Department of Environmental Management
MHAB: Multi-habitat
MPN: Most Probable Number
MS/MSD: Matrix Spike/Matrix Spike Duplicate
NHD: National Hydrography Database
NHEERL: National Health Environmental Effects Research Laboratory
NPDES: National Pollutant Discharge Elimination System
NTU: Nephelometric Turbidity Unit(s)
OEA: Office of External Affairs
OHEPA: Ohio Environmental Protection Agency
OWQ: Office of Water Quality
PFD: Personal Floatation Device
PPE: Personal Protective Equipment
QA: Quality AssuranceQC: Quality Control
QAPP: Quality Assurance Project Plan
QHEI: Qualitative Habitat Evaluation Index
RPD: Relative Percent Difference
SM: Standard Method
SOLAS: Safety of Life at Sea
SOP: Standard Operating Procedure
S.U.: Standard Units
TMDL: Total Maximum Daily Load
U.S. EPA: United States Environmental Protection Agency
USGS: Unites States Geological Survey
WAPB: Watershed Assessment and Planning Branch
WQMS: Water Quality Monitoring Strategy

DEFINITIONS

Backwater	A part of the river not reached by the current, where the water is stagnant.
Elutriate	To purify, separate, or remove lighter or finer particles by washing, decanting, and settling.
Fifteen (15) minute pick	A component of the IDEM multihabitat macroinvertebrate sampling method, used to maximize taxonomic diversity while in the field, in which the one minute kick sample and fifty meter sweep sample collected at a site are first combined and elutriated. Macroinvertebrates are then manually removed from the resulting sample for 15 minutes.
Fifty (50) meter sweep	A component of the IDEM multihabitat macroinvertebrate sampling method in which approximately 50 meters (50 m) of shoreline habitat in a stream or river is sampled with a standard 500 micrometer (500 µm) mesh width D-frame dipnet by taking 20-25 individual “jab” or “sweep” samples, which are then composited.
Impoundment	A body of water confined within an enclosure, such as a reservoir.
Lotic	A waterbody, such as a stream or river, in which the water is flowing.
Macroinvertebrate	Aquatic animals which lack a backbone, are visible without a microscope, and spend some period of their lives in or around water.
Marsh	An area of low-lying land that is flooded in wet seasons, and typically remains waterlogged at all times.
One (1) minute kick sample	A component of the IDEM multihabitat macroinvertebrate sampling method in which approximately one square meter (1 m^2) of riffle or run substrate habitat in a stream or river is sampled with a standard 500 micrometer (500 µm) mesh width D-frame dipnet for approximately one (1) minute.
Ocular reticle	A thin piece of glass marked with a linear or areal scale that is inserted into a microscope ocular, superimposing the scale onto the image viewed through the microscope.
Perennial	A stream that has continuous flow in the stream bed all year during years of normal rainfall. Water must be present in at least 50% of the stream reach during the time of fish community sampling.
Periphyton	Algae attached to an aquatic substrate.

Reach	A segment of a stream used for fish community sampling equal in length to 15 times the average wetted width of the stream, with a minimum length of 50 meters and a maximum length 500 meters.
Seston	Organisms and non-living matter swimming or floating in a water body.
Target	A sampling point which falls on a perennial stream within the basin of interest and the boundaries of Indiana.
Wetland	An area of land (such as a marsh or swamp) that is covered with shallow water.

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I. PROJECT MANAGEMENT/PLANNING

Project Objective

The main objective of the probabilistic monitoring project is to provide a comprehensive, unbiased assessment of the ability of rivers and streams in the Lower Wabash River Basin to support aquatic life and recreational uses. A secondary objective of this project is diatom identification and enumeration, with the goal of developing algal metrics to support nutrient criteria development. Sampling for this project will begin in April and continue through October 2016. Chemical, physical, and biological parameters will be collected. Laboratory processing and data analysis for the project will continue through spring of 2017. Data collected during probabilistic monitoring will be used for the following purposes:

- To provide water quality and biological data for assessment of aquatic life and recreational use as integral components of the Integrated Report, thus satisfying 305(b) and 303(d) reporting requirements to U.S. EPA.

- To give a statistically valid estimation of the percent of stream miles supporting or non-supporting for aquatic life and recreational uses in the basin of interest.

- To provide water quality and biological data which may be useful for municipal, industrial, agricultural, and recreational decision making processes. These include the TMDL process and National Pollutant Discharge Elimination System (NPDES) permit modeling.

- To compile water quality and biological data for trend analyses and future pollution abatement activities.

- To aid in the development of nutrient criteria as well as refined chemical and narrative biological water quality criteria.

Project/Task Organization and Schedule

Table 1. 2016 Probabilistic Monitoring Tasks, Schedule, and Evaluation

Activity	Date(s)	Number of Sites	Frequency of Sampling-related activity	Parameter to be sampled	How evaluated
Site Selection	Mar 2015	100 per basin of interest			Ordered randomly generated list by NHEERL, Western Ecology Division, Corvallis, OR. Sites are stratified in equal numbers of 1st, 2nd, 3rd, and 4th + stream order sites
Site Reconnaissance	Jan – Mar 2016	All 100 sites	At least one visit but may require several to obtain final approval		Land owner approval and stream access and safety characteristics for first 75 sites; "Target" or "Non-target" designations for remaining 25 sites.
Bacteriological Sampling	Apr – Oct 2016	First 40 target sites	Five times at equally-spaced intervals over a 30-day period	*E. coli*	Geometric mean (action level is ≥125 CFU/100mL or ≥125 MPN/100 mL); sampled during recreational season
Biological Sampling	June – mid Nov 2016	First 38 target sites	Fish Community (Jun 6 – Oct 14) Macroinvertebrate Community (Jul 11 – Nov 18) Qualitative Habitat Evaluation Index (QHEI)	Fish Community Macroinvertebrate Community Habitat Quality	Fish Index of Biotic Integrity (IBI) Macroinvertebrate IBI QHEI evaluated separately for fish and macroinvertebrate communities
Water Chemistry	May, July, Sept – Oct 2016	First 45 target sites	Once each in May, July, and Sept – Oct with a minimum 30 days between sampling events	Phosphorous Nitrogen (NO_3 & NO_2) Dissolved O_2 pH Algal conditions Dissolved Metals (See Table 9) Arsenic (III) Nitrogen Ammonia Chloride Cyanide Sulfate Dissolved Solids	Once@ >0.3 mg/L (for nutrients) Once@ >10.0 mg/L (for nutrients) <4.0 mg/L; >12 mg/L (for nutrients) >9.0 Standard Units (for nutrients) Excessive (for nutrients, based on a visual inspection) CAC based on hardness 190 µg/L CAC based on pH and temperature CAC based on hardness and sulfate 200 µg/L Based on hardness and chloride 750 mg/L
Algal Samples	Sept – Oct 2016	First 45 target sites	Once with the 3rd water chemistry sample in Sept or Oct	Algal Diatoms Algal Biomass	Diatom identification and enumeration Chlorophyll *a* and Pheophytin *a*

Background and Project/Task Description

The Probabilistic Monitoring Program was created in 1996 and is operated through the WAPB of IDEM. Other organizations which help with data preparation, collection, and analysis include the United States Geological Survey (USGS), private laboratories under contract with the State of Indiana (e.g., Pace Analytical), the Department of Biological and Environmental Sciences at Georgia College and State University, the U.S. EPA National Health Environmental Effects Research Laboratory (NHEERL), U.S. EPA Region V, and the Indiana Department of Natural Resources (DNR). Landowners and property managers throughout the state also participate in the Probabilistic Monitoring Program by assisting staff to access remote stream locations to collect samples.

The Probabilistic Monitoring Program provides a comprehensive, unbiased assessment of all Indiana streams for their ability to support aquatic life and recreational uses by sampling randomly-generated sites in major Indiana river basins. Major river basins are sampled using a nine-year rotating basin approach to assess and characterize overall water quality and biological integrity (see Section II on MEASUREMENT/DATA ACQUISITION for random site selection details, QAPP ELEMENT B1). For target sites, the following categories of data will be investigated and utilized for assessment purposes: bacteriological contamination in the form of *E. coli*, water chemistry and algal samples (seston and periphyton), fish and macroinvertebrate assemblages, and habitat evaluations.

The U.S. EPA recommends the use of multiple bioindicators (i.e. using fish and macroinvertebrate communities and amount of chlorophyll a derived from algae), facilitating the "weight-of-evidence" approach to interpretation of biomonitoring results (U.S. EPA, 2004). This approach involves interpreting data from multiple sources to arrive at conclusions about an environmental system or stressors such as nutrients. Multiple lines of evidence utilizing more than one bioindicator can be valuable in correlating critical levels of nutrients to stream biota. Diatom identification and enumeration will aid in establishing algal metrics as part of nutrient criteria being developed for Indiana's lotic surface waters.

Data Quality Objectives (DQO)

The DQO process (U.S. EPA 2006) is a planning tool for data collection activities. It provides a basis for balancing decision uncertainty with available resources. The DQO is required for all significant data collection efforts for a project and is a seven-step systematic planning process used to clarify study objectives, define the types of data needed to achieve the objectives, and establish decision criteria for evaluating data quality. The DQO process for the Probabilistic Monitoring Program is identified in the following seven steps.

1. State the Problem
Assessments: Indiana is required to assess all waters of the state to determine their designated use attainment status**. "**Surface waters of the state are designated for full-body contact recreation" and "will be capable of supporting" a "well-balanced, warm water aquatic community" [327 IAC 2-1-3]. This project will gather bacteriological, biological (algal, fish and macroinvertebrate), chemical, and habitat data for the purpose of assessing the designated use attainment status of the Lower Wabash River Basin.

Nutrient Criteria: The U.S. EPA mandated that states either adopt U.S. EPA's nutrient criteria or develop criteria specific to waters within each state by the year 2004 (U.S. EPA 2000a, 2000b, 2000c). An extension was given to several states (including Indiana) that submitted plans describing data needs, analyses, and protocols that would be used in developing nutrient water quality criteria. Since 2001, IDEM and the USGS have collaborated on several projects which have provided the technical background for developing nutrient criteria for rivers and streams in Indiana. The U.S. EPA has recommended a multiple-lines-of-evidence approach for developing nutrient criteria and has, therefore, approved the implementation of a program that includes the

identification and enumeration of diatoms. In order to develop numeric nutrient criteria for rivers and streams in Indiana, IDEM and the USGS have statistically analyzed water chemistry, fish, macroinvertebrate, and chlorophyll data from 2005-2009 (Caskey et al. 2013). The addition of taxonomic analysis of periphyton samples to the existing data set will add another line of evidence in this endeavor.

2. Identify the Decision

An objective of this project is to produce a statistically valid estimation of the percent of stream miles supporting or non-supporting for aquatic life use and recreational use in the Lower Wabash River Basin. To produce this estimation, each target site will be sampled for concentrations of physical, chemical, and biological parameters and evaluated as "supporting" or "non-supporting" when compared with water quality criteria shown in Table 2 [327 IAC 2-1-6] following Indiana's 2014 Consolidated Assessment Listing Methodology (CALM, IDEM 2014b).

In addition to the physical, chemical, and bacteriological criteria listed in Table 2, data for several nutrient parameters will be evaluated with the benchmarks listed below (IDEM 2014b). Assuming a minimum of three sampling events, if two or more of the conditions below are met on the same date, the waterbody will be classified as non-supporting due to nutrients.

- Total Phosphorus: one or more measurements >0.3 mg/L
- Nitrogen (measured as NO_3+NO_2): one or more measurements >10.0 mg/L
- Dissolved Oxygen: <4.0 mg/L; measurements consistently at or close to the standard range of 4.0-5.0 mg/L; or >12.0 mg/L
- pH: >9.0 Standard Units (S.U.) or measurements consistently at or close to the standard range of 8.7-9.0 S.U.
- Algal Conditions: visually observed as "Excessive" by trained staff using best professional judgment. Further explanation of this observance documented in Measurement/Data Acquisition under Algal Community Data on Page 28.

<u>Biological Criteria:</u>

Indiana narrative biological criteria [327 IAC 2-1-3] states that "all waters, except as described in subdivision (5)," (i.e., limited use waters) "will be capable of supporting" a "well-balanced, warm water aquatic community". The water quality standard definition of a "well-balanced aquatic community" is "an aquatic community that: (A) is diverse in species composition; (B) contains several different trophic levels; and (C) is not composed mainly of pollution tolerant species" [327 IAC 2-1-9]. An interpretation or translation of narrative biological criteria into numeric criteria would be as follows: A stream segment is non-supporting for aquatic life use when the monitored fish or macroinvertebrate community receives an Index of Biotic Integrity (IBI) score of less than 36 (on a scale of 0-60 for fish and 12-60 for macroinvertebrate communities), which is considered "Poor" or "Very Poor" (IDEM 2014b).

To assist in the development of nutrient criteria, benthic diatoms will be collected in conjunction with chemical, chlorophyll *a*, and pheophytin *a* data from each site, along with field parameters and physical site descriptions. Once collected, the samples will be preserved and transported to the IDEM laboratory where algae will be identified and enumerated as part of the development of algal metrics.

Following the assessment of each site sampled in the Lower Wabash River Basin, percent of stream miles attaining and not attaining recreational use and aquatic life use designations will be calculated. First a spreadsheet is developed which lists the following site information:

- all sites that were initially drawn
- their status (i.e. access denied; site sampled for biology, chemistry, or both; an overdraw site that was not needed)
- the assessment status of the site (impaired; not impaired; NA for denials and unused overdraw sites)

- a weight (based on stream order and stream miles within the basin).

This data is then analyzed with a software package (spsurvey) that is used with the R statistics program; instructions on how to download and use the software are available at: http://archive.epa.gov/nheerl/arm/web/html/software.html. The end product of this analysis is an estimate of the number of stream miles that are impaired (or not) along with confidence intervals for that particular basin. Calculated mileages will be reported to U.S. EPA in the 2018 update of Indiana's Integrated Water Monitoring and Assessment Report. Sites not attaining recreational use criteria will be listed in the Section 303(d) List of Impaired Waters for Indiana. Sites not attaining the aquatic life use support (ALUS) designation will be forwarded to the Targeted Monitoring Program for possible additional sampling to determine the extent, cause(s), and likely source(s) of the ALUS non-attainment area.

Site-specific data will be used to classify associated assessment units (AU) into one of five major categories in the state's Consolidated list (IDEM 2014b), which is included in the Integrated Report (IDEM 2014a). The geographical extent and location of each AU within a given 12- or 14-digit Hydrologic Unit Code (HUC) is defined for mapping purposes through a process called reach indexing, which assigns a unique assessment unit identification number to one or more reaches in the National Hydrography Dataset (NHD). In flowing waters, Strahler Stream Order is the primary factor in determining AU extent. AUs for smaller 1st and 2nd order streams may include all of the waters within the streams' watershed boundary. AUs for larger 3rd and 4th order streams may be larger and include several small 1st or 2nd order tributaries. Sample results from 5th+ order streams are generally only applicable to the mainstem of the river (not including any tributaries) and the AU may begin or end at a point where a major tributary enters the stream. This "key" is called the Reach Index and allows IDEM to map its assessment information (U.S. EPA and USGS 2005). Categories in Indiana's Consolidated List (IDEM 2014b, U.S. EPA 2005) are:

Category 1 **Attaining the water quality standard for all designated uses and no use is threatened.** Waters should be listed in this category if there are data and information that meet the requirements of the state's assessment and listing methodology and support a determination that all WQS are attained and no designated use is threatened.

Category 2 **Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.** Waters should be listed in this category if there are data and information that meet the requirements of the state's assessment and listing methodology to support a determination that some, but not all, designated uses are attained and none is threatened.

Category 3 **Insufficient data and information to determine if any designated use is attained.** Little or no information is available with which to make an assessment. Waters should be listed in this category where the data or information to support an attainment determination for any designated use are not available or are not consistent with the requirements of the state's assessment and listing methodology. States should schedule monitoring on a priority basis to obtain data and information necessary to classify these waters as Category 1, Category 2, Category 4, or Category 5.

Category 4 **Impaired or threatened for one or more designated uses but does not require the development of a TMDL.**

A. A TMDL has been completed that results in attainment of all applicable WQS and has been approved by the U.S. EPA. Monitoring should be scheduled for these waters to verify that the WQS are met when the water quality management actions needed to achieve all TMDLs are implemented.
B. Other pollution control requirements are reasonably expected to result in the attainment of the WQS in a reasonable period of time. Consistent with the regulation under 40 CFR Part 130.7(b)(i), (ii), and (iii), waters should be listed in this subcategory where other pollution control requirements required by local,

state, or federal authority are stringent enough to achieve any water quality standard (WQS) applicable to such waters. Monitoring should be scheduled for these waters to verify that the WQS are attained as expected.

C. Impairment is not caused by a pollutant. Waters should be listed in this subcategory if the impairment is not caused by a pollutant but is attributed to other types of pollution for which a total maximum daily load cannot be calculated.

Category 5 **The water quality standard is not attained. Waters may be listed in both 5A and 5B depending on the parameters causing the impairment.**

A. The waters are impaired or threatened for one or more designated uses by a pollutant or pollutants and require a TMDL. This category constitutes the Section 303(d) list of waters impaired or threatened by a pollutant or pollutants for which one or more TMDLs are needed. Waters should be listed in this category if it is determined in accordance with the state's assessment and listing methodology that a pollutant has caused, is suspected of causing, or is projected to cause impairment. Where more than one pollutant is associated with the impairment of a single AU, the AU will remain in Category 5 until TMDLs for all pollutants have been completed and approved by the U.S. EPA.

B. The waterbody AUs are impaired due to the presence of mercury or PCBs, or both, in the edible tissue of fish collected from the AUs at levels exceeding Indiana's human health criteria for these contaminants. This category also comprises a portion of the Section 303(d) List of Impaired Waters, but the state believes that a conventional TMDL is not the appropriate approach. The state will continue to work with the general public and the U.S. EPA on actual steps needed ultimately to address these impairments.

Table 2. Water Quality Criteria [327 IAC 2-1-6]

Parameter	Level	Criterion
Metals (dissolved; Cd, Cr (III/VI), Cu, Pb, Ni, Zn))	Calculated based on hardness	CAC
Arsenic III (dissolved)	190 µg/L	CAC
Ammonia Nitrogen	Calculated based on pH and temperature	CAC
Chloride	Calculated based on hardness and sulfate	CAC
Cyanide	Total = 200 µg/L Free = 5.2 µg/L (analyzed only if hit on Total)	Human Health point of drinking water intake CAC
Dissolved Oxygen	At least 5.0 mg/L (warm water aquatic life) At least 6.0 mg/L (cold-water fish*)	Not less than 4.0 mg/L at any time. Not less than 6.0 mg/L at any time and shall not be less than 7.0 mg/L in areas where spawning occurs during the spawning season and in areas used for imprinting during the time salmonids are being imprinted.
pH	6.0 - 9.0 S.U.	Must remain between 6.0 and 9.0 S.U. except for daily fluctuations that exceed 9.0 due to photosynthetic activity
Nitrate-N+Nitrite-N	10 mg/L	Human Health point of drinking water intake
Sulfate	Calculated based on hardness and chloride	In all waters outside the mixing zone
E. coli (April-October Recreational season)	125 CFU/100mL or 125 MPN/100 mL 235 CFU/100 mL or 235 MPN/100 mL	5 sample geometric mean based on at least 5 samples equally spaced over a 30 day period Not to exceed in any one sample in a 30 day period except in cases where there are at least 10 samples, 10% of the samples may exceed the criterion
Dissolved Solids	750 mg/L	Public water supply

CAC = Chronic Aquatic Criterion, S.U. = Standard Units, MPN = Most Probable Number, CFU = Colony Forming Unit

*Waters protected for cold-water fish include those waters designated by the Indiana Department of Natural Resources for put-and-take trout fishing, as well as salmonid waters listed in 327 IAC 2-1.5-5. This information is provided for completeness; no such waters are part of the current work plan.

3. Identify the Input to the Decision

Under the probabilistic design, field monitoring activities are required to collect physical, chemical, algal, bacteriological, biological, and habitat data. These data are required to address the necessary decisions previously described. Monitoring activities will take place at target sites for which permission to access has been granted by the necessary landowners or property managers. Due to the statistical nature of the survey design, historical data will not be used in the calculation of predicted stream mileages supporting or non-supporting aquatic life or recreational uses. Collection procedures for field measurements, bacteriological, algal, chemical, biological, and habitat data will be described in detail under Section II. MEASUREMENT/DATA ACQUISITION.

4. Define the Boundaries for the Study

For the purpose of this program, the Lower Wabash River Basin (Figure 1) is geographically defined as within the borders of Indiana contained by the 8-digit HUCs 05120108, 05120109, 05120110, 05120111 and 05120113. This area includes:

- The Middle Wabash River – Little Vermillion River sub-basin (05120108) located in west-central Indiana drains approximately 2066 square miles within Indiana borders. Using the 2011 National Land Cover Database for the Conterminous United States, predominant land uses are cropland (67%), forest (17%), urban (8%), and pasture (6%) (Jin et al. 2013).
- The Vermillion River sub-basin (05120109) located in west-central Indiana drains approximately 136 square miles within Indiana borders. Predominant land uses are cropland (84%), forest (7%), urban (5%), and pasture (3%) (Jin et al. 2013).
- The Sugar Creek sub-basin (05120110) located in west-central Indiana drains approximately 811 square miles. Predominant land uses are cropland (75%), forest (12%), urban (8%), and pasture (3%) (Jin et al. 2013).
- The Middle Wabash River – Busseron Creek sub-basin (05120111) located in southwestern Indiana drains approximately 1123 square miles within Indiana borders. Predominant land uses are cropland (54%), forest (25%), urban (10%), and pasture (5%) (Jin et al. 2013).
- The Lower Wabash River sub-basin (05120113) located in southwestern Indiana drains approximately 666 square miles within Indiana borders. Predominant land uses are cropland (70%), forest (14%), urban (9%), and open water (3%) (Jin et al. 2013).

The target sample population for the basin is defined as all perennial streams in the Lower Wabash River Basin that lie within the geographic boundaries of Indiana. The sample frame is comprised of all rivers, streams, canals, and ditches as indexed through the NHD-Plus dataset (U.S. EPA and USGS 2005). Marshes, wetlands, backwaters, impoundments, dry sites, and streams with no apparent channel (i.e. submerged or run underground either through natural processes or by anthropogenic channel alterations) are excluded as they are considered non-target populations. Table 3 gives the site status for 100 potential sampling sites for the Lower Wabash River Basin. From these 100 potential sites, the first 45 target sites will be sampled for physical, chemical, and algal parameters. Bacteriological sampling will be completed at the first 40 target sites. Biological communities and habitat information will be sampled at the first 38 target sites. For those sites listed as “Target, Approved” but not sampled in Table 3, the site will be listed as “Not-needed” when using the “R” statistics software (R Core Team 2014) available on the U.S. EPA Aquatic Resources Monitoring and Analysis webpage (http://archive.epa.gov/nheerl/arm/web/html/software.html) to calculate the percent of perennial stream miles in the basin that support or do not support aquatic life and recreational uses. Sites listed as “Other, Deadline 3/11/2016” in Table 3 were thought to be part of the target population; however, the landowner could not be contacted before the site reconnaissance deadline which occurred on March 11, 2016.

5. Develop a Decision Rule

Samples will be collected for physical, chemical, and bacteriological parameters, as well as algal and biological communities, if the flow is not dangerous for staff to enter the stream (e.g., water levels at or below median base flow), and barring any hazardous weather conditions (e.g., thunderstorms or heavy rain in the vicinity) or unexpected physical barriers to accessing the site. The field crew chief makes the final determination as to whether or not a stream is safe to enter. Even if the weather conditions and stream flow are safe, sample collections for algal and biological communities may be postponed at a particular site for one to four weeks due to scouring of the stream substrate or instream cover following a high water event resulting in non-representative samples.

For assessment purposes in the Indiana Integrated Water Monitoring and Assessment Report, aquatic life use and recreational use support decisions will include independent evaluations of chemical, biological, and bacteriological criteria as outlined in Indiana's 2014 CALM (IDEM 2014b, 36 - 38). The fish assemblage will be evaluated at each site using the appropriate IBI (Simon DRAFT; Simon 2006; Simon and Dufour 1998, 2005). Macroinvertebrate multi-habitat samples will also be evaluated using an IBI developed for lowest practical taxonomic level identifications. Specifically, a site will be considered non-supporting for aquatic life use when IBI scores are less than 36. Where biological or chemical criteria are non-supporting for aquatic life use, the site will be forwarded to the Targeted Monitoring Program for possible investigation to identify the extent of the non-support status, determine potential causes, and list the most probable sources of the identified stressors.

Statistical estimations of the percentage of perennial stream miles in the Lower Wabash River Basin that support or do not support aquatic life and recreational uses will be made following use attainment decisions for each site sampled. Estimations will be calculated using the "R" Free Software (R Core Team 2014) available on the U.S. EPA Aquatic Resources Monitoring and Analysis webpage http://archive.epa.gov/nheerl/arm/web/html/software.html. The webpage includes an example for Indiana streams including documentation, data files, "R" procedures, and results files. The percent attainment and non-attainment for the target population (Lower Wabash River Basin) will be published in a table within the 2018 Indiana Integrated Water Monitoring and Assessment Report.

IDEM's intention is to use algal metrics, once determined, as part of nutrient criteria being developed for Indiana's surface waters. Eventually, IDEM also plans to use algal metrics with macroinvertebrate and fish metrics for ALUS decisions. Given that ecological tolerances for many diatom species are known, changes in diatom community composition can be used to diagnose the environmental stressors affecting ecological health (Stevenson 1998; Stevenson and Pan 1999); thus, periphyton IBI metrics have been developed and tested in many regions (Kentucky Department of Environmental Protection 1993; Hill 1997). The periphyton assemblage may be used to assess biological integrity of a waterbody without any other information; however, periphyton are most effective when used with habitat and macroinvertebrate assessments, particularly because of the close relationship between periphyton and these elements of stream ecosystems (Barbour et al. 1999). For this reason, algal sampling will be conducted at the same sites where macroinvertebrates, fish, habitat, chemical, and physical data will be collected as part of the Probabilistic Monitoring Program.

Figure 1. Potential Sampling Sites for the Lower Wabash River Basin.

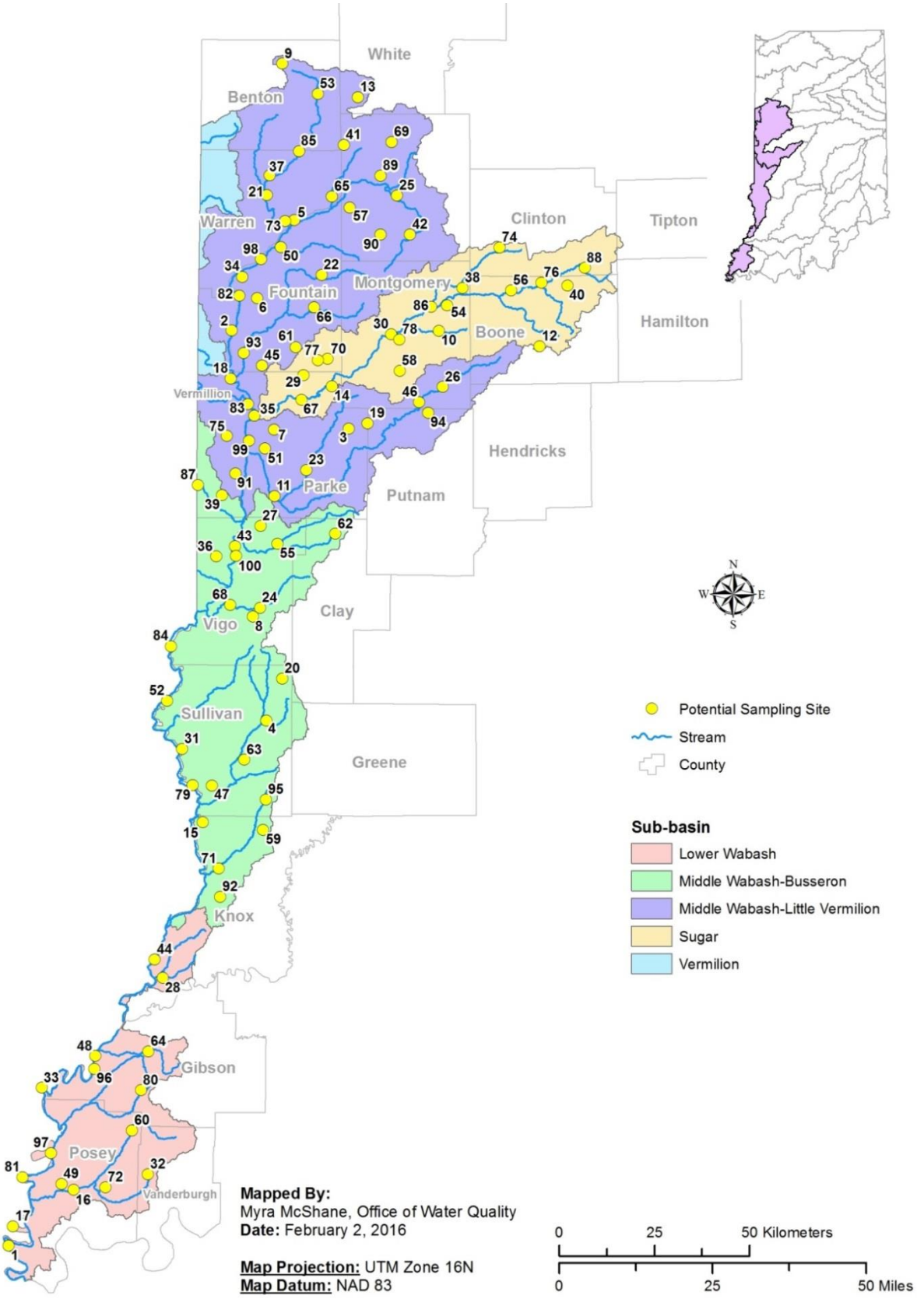

Table 3. List of Potential Sites for the Lower Wabash River Basin.

Site #	AIMS Site Name	Stream Name and Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)	Topo	Stream Order	Site Status
1	WLW-09-0001	Wabash River @ Spencer Ditch Road	Posey	37.88268638	-88.08145813	J-56	8	Target, Approved
2	WLV-08-0001	Wabash River @ Water Street	Fountain	40.0496168	-87.42963741	E-25	6	Target, Approved
3	WLV-13-0011	South Fork Little Raccoon Creek @ CR 900 E	Parke	39.81874918	-87.0695825	F-05	3	Target, Approved
4	WBU-15-0036	Busseron Creek @ CR 300 N	Sullivan	39.12773109	-87.31790452	G-50	3	Non-target, Phys. Barriers
5	WLV-05-0108	Kickapoo Creek	Warren	40.31149619	-87.23846082	D-50	3	Non-target, Backwater
6	WLV-09-0001	Graham Creek @ Mud Creek Road	Fountain	40.12663196	-87.35198553	E-03	2	Target, Approved
7	WLV-15-0001	Leatherwood Creek @ 10 Oclock Road	Parke	39.81606034	-87.29744036	F-03	3	Target, Approved
8	WBU-07-0002	Tributary of Honey Creek @ McDaniel Road	Vigo	39.3741908	-87.36118001	G-26	1	Target, Approved
9	WLV-04-0001	Big Pine Creek Ditch	Benton	40.68060409	-87.27631154	C-49	2	Non-target, Dry
10	WSU-03-0001	Little Sugar Creek	Montgomery	40.04922071	-86.79269095	E-30	3	Non-target, Access Denied
11	WLV-15-0002	Rock Run @ CR 325 W	Parke	39.6590715	-87.29646838	F-26	3	Target, Approved
12	WSU-04-0001	Shaw Ditch	Boone	40.01259512	-86.48329485	E-33	1	Non-target, Dry
13	WLV-04-0005	Vanatta Ditch	White	40.60218476	-87.04181368	D-05	1	Non-target, Dry
14	WSU-06-0009	Montgomery Ditch	Parke	39.91863108	-87.12128075	E-51	1	Non-target, Dry
15	WBU-17-0001	Old Busseron Creek	Knox	38.88708659	-87.51012462	H-25	2	Non-target, Backwater
16	WLW-07-0005	Big Creek @ Johnson Road	Posey	38.01650478	-87.88921628	J-39	4	Target, Approved
17	WLW-09-0002	Old River	Posey	37.92826393	-88.06907398	J-56	1	Non-target, Wetland
18	WLV-16-0002	Wabash River @ CR 251	Vermillion	39.93647677	-87.43231974	E-48	7	Target, Approved
19	WLV-13-0012	Tributary of South Fork Little Raccoon Creek	Parke	39.83136136	-87.01239382	F-05	1	Non-target, Access Denied
20	WBU-15-0037	Boston Creek	Sullivan	39.22782215	-87.27057432	G-50	1	Non-target, Impounded
21	WLV-04-0002	Big Pine Creek @ CR 50 W	Warren	40.37043829	-87.32249831	D-49	5	Target, Approved
22	WLV-07-0006	North Fork Coal Creek @ SR 341	Fountain	40.18208361	-87.15317923	E-04	2	Target, Approved
23	WLV-13-0013	Williams Creek @ CR 225 E	Parke	39.72070859	-87.19906829	F-27	2	Target, Approved
24	WBU-07-0003	Honey Creek	Vigo	39.39465774	-87.33911924	G-03	3	Other, Deadline 3/11/2016
25	WLV-01-0080	Wea Creek @ US 231	Tippecanoe	40.36954715	-86.9204764	D-52	3	Target, Approved
26	WLV-12-0004	Big Raccoon Creek @ SR 234	Montgomery	39.91694605	-86.78102158	E-53	2	Target, Approved
27	WBU-06-0003	Spring Creek @ Spring Creek Road	Vigo	39.58827657	-87.33796823	F-49	3	Target, Approved
28	WLW-02-0001	River Deshee @ Beal Road	Knox	38.51963418	-87.62725868	I-22	1	Target, Approved
29	WSU-05-0001	Sugar Mill Creek @ Thomas Road	Parke	39.94492122	-87.20822331	E-50	4	Target, Approved
30	WSU-06-0014	Sugar Creek @ CR 225 W	Montgomery	40.04167867	-86.93924571	E-29	5	Target, Approved
31	WBU-16-0018	Clear Pond Ditch @ Merom Public Access	Sullivan	39.06038119	-87.57335903	H-02	2	Target, Approved
32	WLW-07-0002	Little Creek @ Number 6 School Road	Vanderburgh	38.05457354	-87.66749064	J-41	1	Target, Approved
33	WLW-06-0001	Wabash River	Gibson	38.25676632	-87.9881718	J-01	8	Non-target, Wetland
34	WLV-06-0002	Mud Run	Fountain	40.17654454	-87.39730231	E-02	2	Non-target, Other
35	WSU-06-0010	Sugar Creek @ CR 550 W	Parke	39.84901057	-87.35877452	F-03	5	Target, Approved
36	WBU-05-0002	Wolf Creek @ N Arms Place	Vigo	39.51548006	-87.47323147	F-48	2	Target, Approved
37	WLV-04-0003	Big Pine Creek	Warren	40.4172986	-87.3137368	D-26	4	Other, Deadline 3/11/2016
38	WSU-04-0002	Withe Creek	Montgomery	40.15078214	-86.71942829	E-08	1	Other, Deadline 3/11/2016
39	WBU-03-0001	Tributary of Brouilletts Creek @ SR 163	Vermillion	39.66020116	-87.45601116	F-25	1	Target, Approved
40	WSU-01-0009	Mud Creek @ CR 400 E	Boone	40.15544226	-86.39609766	E-10	3	Target, Approved
41	WLV-05-0109	Otterbein Ditch	Tippecanoe	40.48912585	-87.08542066	D-28	1	Other, Deadline 3/11/2016
42	WLV-01-0081	Wea Creek @ CR 100 E	Tippecanoe	40.2773794	-86.88032549	D-52	3	Target, Approved
43	WBU-06-0001	Wabash River @ US 41	Vigo	39.54001235	-87.41630204	F-48	7	Target, Approved
44	WLW-02-0002	Wabash River @ CR 1200 S	Knox	38.56217922	-87.65222729	I-22	7	Target, Approved
45	WLV-16-0003	Mill Creek @ CR 1120 S	Fountain	39.96710301	-87.33580806	E-49	3	Target, Approved
46	WLV-12-0005	Cornstalk Creek @ Cornstalk Creek Road	Montgomery	39.88145506	-86.85377034	E-53	1	Target, Approved
47	WBU-15-0038	Rogers Ditch @ CR 400	Sullivan	38.97414934	-87.48270459	H-26	1	Target, Approved
48	WLW-03-0002	Wabash River @ CR 1500 W	Gibson	38.33300323	-87.82822518	J-02	8	Target, Approved
49	WLW-07-0003	Fun Creek @ Smith School Road	Posey	38.03012296	-87.9257865	J-39	1	Target, Approved
50	WLV-06-0004	Big Shawnee Creek @ CR 70 W	Fountain	40.24786328	-87.27937865	E-03	3	Target, Approved

Table 3 (continued). List of Potential Sites for the Lower Wabash River Basin.

Site #	AIMS Site Name	Stream Name and Location	County	Latitude (Decimal Degree)	Longitude (Decimal Degree)	Topo	Stream Order	Site Status
51	WLV-15-0003	Rocky Run @ CR 420 W	Parke	39.77091715	-87.32537247	F-03	2	Target, Approved
52	WBU-11-0001	Wabash River @	Sullivan	39.17365167	-87.61997485	G-48	7	Target, Approved
53	WLV-04-0006	Big Pine Creek @ CR 850 E	Benton	40.60930521	-87.16635083	D-04	3	Target, Approved
54	WSU-04-0003	Honey Creek @ SR 47	Montgomery	40.10929888	-86.76731073	E-30	2	Target, Approved
55	WBU-04-0005	North Branch Otter Creek @ Hayne Road	Vigo	39.54651303	-87.28636642	F-49	3	Target, Approved
56	WSU-01-0010	Sugar Creek @ Frankfort Road	Boone	40.14498669	-86.57048355	E-09	4	Target, Approved
57	WLV-05-0110	Flint Creek @ CR 510 S	Tippecanoe	40.3409368	-87.06701219	D-51	3	Target, Approved
58	WSU-06-0011	Rattlesnake Creek	Montgomery	39.95567463	-86.91298626	E-52	1	Other, Deadline 3/11/2016
59	WBU-18-0001	Tributary of Maria Creek	Knox	38.87027617	-87.32767014	H-50	1	Other, Deadline 3/11/2016
60	WLW-07-0006	Big Creek @ Saint Wendel Cynthiana Road	Posey	38.15765074	-87.71631437	J-22	3	Target, Approved
61	WLV-16-0004	Mill Creek @ CR 800 S	Fountain	40.01095912	-87.23235099	E-27	1	Target, Approved
62	WBU-04-0006	Otter Creek @ Private Road 1275 N	Clay	39.56991969	-87.10969571	F-51	1	Target, Approved
63	WBU-15-0039	Robbins Branch @ CR 350 S	Sullivan	39.03555655	-87.38532737	H-03	1	Target, Approved
64	WLW-03-0003	Brown Ditch	Gibson	38.34486168	-87.66903933	J-03	2	Other, Deadline 3/11/2016
65	WLV-05-0111	Little Pine Creek	Warren	40.36744801	-87.12153442	D-51	3	Other, Deadline 3/11/2016
66	WLV-07-0007	East Fork Coal Creek	Fountain	40.10542282	-87.17689512	E-27	3	Other, Deadline 3/11/2016
67	WSU-06-0012	Sugar Creek @ Turkey Run SP	Parke	39.88624897	-87.21478339	E-50	5	Target, Approved
68	WBU-07-0004	Honey Creek	Vigo	39.40131599	-87.42974121	G-02	3	Other, Deadline 3/11/2016
69	WLV-02-0030	Cole Ditch @ CR 150 W	Tippecanoe	40.49567897	-86.93709408	D-29	1	Target, Approved
70	WSU-05-0002	Stillwater Creek @ Luthern Church Road	Fountain	39.98375983	-87.13478368	E-50	3	Target, Approved
71	WBU-18-0002	Maria Creek @ Ivers Road	Knox	38.77792733	-87.46134075	H-49	2	Target, Approved
72	WLW-07-0004	Tributary of Little Creek @ Caborn Road	Posey	38.02308656	-87.79436264	J-40	1	Target, Approved
73	WLV-04-0004	Big Pine Creek	Warren	40.30893658	-87.26602916	D-49	5	Target, Approved
74	WSU-02-0001	Little Potato Creek	Clinton	40.24587028	-86.60498153	E-09	2	Other, Deadline 3/11/2016
75	WLV-16-0005	Buck Creek	Vermillion	39.80101285	-87.44288103	F-02	3	Other, Deadline 3/11/2016
76	WSU-01-0011	Sugar Creek	Boone	40.16207457	-86.47610521	E-10	4	Other, Deadline 3/11/2016
77	WSU-05-0003	Sugar Mill Creek	Fountain	39.979751	-87.16421244	E-50	4	Other, Deadline 3/11/2016
78	WSU-06-0013	Tributary of Dry Branch	Montgomery	40.02965021	-86.91386688	E-29	2	Non-target, Dry
79	WBU-16-0019	Wabash River	Sullivan	38.97539169	-87.54062912	H-25	7	Target, Approved
80	WLW-05-0001	Black River	Gibson	38.25290791	-87.6905571	J-03	1	Other, Deadline 3/11/2016
81	WLW-08-0001	Wabash River	Posey	38.04511536	-88.04274246	J-38	8	Target, Approved
82	WLV-08-0002	Wabash River	Warren	40.13202209	-87.40622846	E-02	6	Target, Approved
83	WLV-16-0006	Wabash River	Vermillion	39.87554747	-87.37870086	E-48	7	Target, Approved
84	WBU-11-0002	Sugar Creek	Vigo	39.3024473	-87.60923606	G-24	2	Non-target, Backwater
85	WLV-04-0007	Brown Ditch	Warren	40.47392069	-87.22398844	D-27	3	Other, Deadline 3/11/2016
86	WSU-04-0004	Sugar Creek	Montgomery	40.10636634	-86.81612631	E-30	4	Target, Approved
87	WBU-03-0002	Brouilletts Creek	Vermillion	39.68466603	-87.53004177	F-24	5	Other, Deadline 3/11/2016
88	WSU-01-0012	Stowers Ditch	Clinton	40.19633442	-86.34269435	E-11	3	Other, Deadline 3/11/2016
89	WLV-05-0112	Jordan Creek	Tippecanoe	40.41603379	-86.97179471	D-29	1	Other, Deadline 3/11/2016
90	WLV-01-0082	Little Wea Creek	Tippecanoe	40.27671028	-86.97233584	D-52	2	Other, Deadline 3/11/2016
91	WLV-16-0007	Norton Creek	Vermillion	39.71162416	-87.41511391	F-25	3	Other, Deadline 3/11/2016
92	WBU-19-0001	Tributary of Snapp Creek	Knox	38.71159176	-87.45597413	I-02	1	Other, Deadline 3/11/2016
93	WLV-09-0002	Coal Creek	Fountain	39.99679417	-87.39199046	E-48	4	Other, Deadline 3/11/2016
94	WLV-12-0006	Cline Creek	Putnam	39.85572543	-86.82570338	F-07	1	Other, Deadline 3/11/2016
95	WBU-18-0003	Maria Creek	Sullivan	38.94189845	-87.31933781	H-27	1	Other, Deadline 3/11/2016
96	WLW-03-0004	Wabash River	Gibson	38.30249458	-87.8307711	J-02	8	Target, Approved
97	WLW-08-0002	Wabash River	Posey	38.1023741	-87.95804712	J-39	8	Target, Approved
98	WLV-06-0003	Bear Creek @ CR 400 W	Fountain	40.21836141	-87.33932947	E-03	3	Target, Approved
99	WLV-16-0008	Wabash River	Vermillion	39.79005261	-87.37446411	F-03	7	Target, Approved
100	WBU-06-0002	Lost Creek	Vigo	39.51708167	-87.41311336	F-48	2	Other, Deadline 3/11/2016

6. Specify Tolerable Limits on Decision Errors

Good quality data are essential for minimizing decision error. By identifying errors in the sampling design, measurement, and laboratory for physical, chemical, and biological parameters, more confidence can be placed in the percentage of perennial stream miles in the river basin that support or do not support aquatic life and recreational uses as well as the algal metrics produced. In this project, it is desired to make decisions protective of human health and the environment; therefore, the null hypothesis is that the reach is not supportive of Indiana's aquatic life and recreational uses. The resulting Type 1 and Type 2 decision errors in this project are listed in Table 4 below.

Table 4. Decision Error Associated with Probabilistic Monitoring.

	Actual Status of Sampled Stream Reaches of the Studied Watershed	
WAPB Work Plan Findings	**Stream reach IS supportive of aquatic life and recreational use**	**Stream reach IS NOT supportive of aquatic life and recreational use**
Stream reach IS supportive of aquatic life and recreational use	Stream reach is correctly identified as supporting aquatic life and recreational use	**Decision Error (Type 1)**
Stream reach IS NOT supportive of aquatic life and recreational use	**Decision Error (Type 2)**	Stream reach is correctly identified as NOT supporting aquatic life and recreational use

The probabilistic sampling design provides estimations of the proportion of streams in the basin attaining designated uses with a 95% confidence level. A minimum of 38 probabilistic sites will be sampled in the basin to assure this confidence level is reached for overall stream mileage estimations.

Site specific aquatic life use and recreational use assessments include program specific controls to identify the introduction of errors. These controls include water chemistry and bacteriological blanks and duplicates, biological site revisits or duplicates, and laboratory controls through verification of species identifications as described in field procedure manuals (IDEM 2002; Ohio Environmental Protection Agency 2006) and standard operating procedures (IDEM 1992a, 1992b, 1992c, 1992d, 1992e, 2010a, 2015a).

The QA/QC process detects deficiencies in the data collection as set forth in the IDEM QAPP for the Indiana Surface Water Quality Monitoring Program (IDEM 2004). The QAPP requires all contract laboratories to adhere to rigorous standards during sample analyses and to provide good quality usable data. Chemists within the WAPB review the laboratory analytical results for quality assurance. Any data which is "Rejected" due to analytical problems or errors will not be used for water quality assessment decisions. Any data flagged as "Estimated" may be used on a case by case basis and is noted in the QA/QC report. Criteria for acceptance or rejection of results as well as application of data quality
flags is presented in the QAPP, Table D3-1: Data Qualifiers and Flags, pages 130-131. Precision and accuracy goals with acceptance limits for applicable analytical methods are provided in the QAPP, Table A7-1: Precision and Accuracy Goals for Data Acceptability by Matrix, pages 45-47 and Table B2-2: Field Parameters, page 81. Further investigation will be conducted in response to consistent "rejected" data in determining the source of error. Field techniques used during sample collection and preparation, along with laboratory procedures will be subject to evaluation by both the WAPB QA Manager and Project Manager in troubleshooting error introduced

throughout the entire data collection process. Corrective actions will be implemented once the source of error is determined.

If funding and resources are available, results showing non-support for aquatic life use will be subsequently verified through a targeted monitoring program prior to completion of the Indiana Integrated Water Monitoring and Assessment Report. Those stream reaches showing non-support may also be verified through the TMDL development process.

7. Optimize the Design for Obtaining Data

The rotating basin, probability design is optimal for assessing the recreational use and ALUS status of river and stream resources in Indiana. The design facilitates statistically valid estimations of the total percent of perennial stream miles within the basin of interest that are non-supporting for aquatic life and recreational uses. The estimations are derived from total perennial stream miles in the basin of interest and the design requires minimal use of sampling and staff resources.

Periphyton assemblages are impacted by habitat and macroinvertebrate community structure; thus, to develop algal metrics and subsequent nutrient criteria, algal samples will be collected from the same sites generated using the rotating basin, probability design from which fish and macroinvertebrate communities and habitat data are collected.

Training and Staffing Requirements

Table 5. Project Roles, Experience, and Training

Role	Required Training/Experience	Responsibilities	Training References
Project Manager	-Bachelor of Science Degree in biology or other closely related area plus four years of experience in aquatic ecosystems (Masters Degree with two years aquatic ecosystems experience may substitute) - Database experience - Experience in project management and QA/QC procedures	-Establish Project in the Assessment Information Management System (AIMS) II database -Oversee development of Project Work Plan -Oversee entry and QC of field data -Querying data from AIMS II to determine results not meeting Water Quality Criteria -Calculating predicted percentage of perennial stream miles non-supporting for aquatic life uses and recreational uses in the river basin of interest	-AIMS II Database User Guide -U.S. EPA 2006 Quality Assurance (QA) Documents on developing Work Plans(QAPPs)
Field Crew Chief-Fish or Macroinvertebrate Community Sampling	-Bachelor of Science Degree in biology or other closely related area - At least one year of experience in sampling methodology and taxonomy of aquatic communities in the region -Annually review the Principles and Techniques	-Completion of field data sheets -Taxonomic accuracy -Sampling efficiency and representation -Voucher specimen tracking -Overall operation of the field crew when remote from central office	-Barbour et al. 1999 -Hydrolab Corporation 2002 -IDEM 1992a, 1992b, 1992c, 1992d, 1992e,2002, 2010a, 2010b,

Role	Required Training/Experience	Responsibilities	Training References
Field Crew Chief- Fish or Macroinvertebrate Community Sampling (Continued)	of Electrofishing -Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	-Adherence to safety and field SOP procedures by crew members -Ensure that multi-probe analyzers are calibrated weekly prior to field sampling activities -Ensure that field sampling equipment is functioning properly and loaded into field vehicles prior to field sampling activities	2010c, 2015b -Klemm et al. 1990 -OHEPA 2006 -Plafkin et al. 1989 -Rankin 1995 -Simon DRAFT -Simon 2006 -Simon and Dufour 1998, 2005 -U.S. EPA 1995 -YSI 2002
Field Crew members- Fish or Macroinvertebrate Community Sampling	-Complete hands-on training for sampling methodology prior to participation in field sampling activities -Review the Principles and Techniques of Electrofishing -Review relevant safety procedures -Review relevant SOP documents for field operations	-Follow all safety and SOP procedures while engaged in field sampling activities -Follow direction of Field Crew Chief while engaged in field sampling activities	-Barbour et al. 1999 -Hydrolab Corporation 2002 -IDEM 1992a, 1992b, 1992c, 1992d, 1992e, 2002, 2010a, 2010b, 2010c, 2015b -Klemm et al. 1990 -OHEPA 2006 -Plafkin et al. 1989 -Rankin 1995 -U.S. EPA 1995 -YSI 2002
Field Crew Chief - Water Chemistry, Algal and/or Bacteriological Sampling	-Bachelor of Science Degree in biology or other closely related area -At least one year of experience in sampling methodology -Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	-Completion of field data sheets -Sampling efficiency and representation -Overall operation of the field crew when remote from central office -Adherence to safety and field SOP procedures by crew members -Ensure that multi-probe analyzers are calibrated weekly prior to field sampling activities -Ensure that field sampling equipment is functioning properly and loaded into field vehicles prior to field sampling activities	-Hydrolab Corporation 2002 -IDEM 1997, 2002, 2010b, 2010c, 2015b -Lowe et al. 2004 -Moulton et al. 2002 -YSI 2002
Field Crew Members - Water	-Complete hands-on training for sampling	-Follow all safety and SOP procedures while engaged	-Hydrolab Corporation

Role	Required Training/Experience	Responsibilities	Training References
Chemistry, Algal and/or Bacteriological Sampling	methodology prior to participation in field sampling activities -Review relevant safety procedures -Review relevant SOP documents for field operations	in field sampling activities -Follow direction of Field Crew Chief while engaged in field sampling activities	2002 -IDEM 1997, 2002, 2010b, 2010c, 2015b -Lowe et al. 2004 -Moulton et al. 2002 -YSI 2002
Laboratory Supervisor - Fish or Macroinvertebrate Community Sample Processing	-Bachelor of Science Degree in biology or other closely related area -At least one year of experience in taxonomy of aquatic communities in the region -Annually review relevant safety procedures -Annually review relevant SOP documents for laboratory operations	-Identification of fish and macroinvertebrate specimens collected during field sampling -Completion of laboratory data sheets -Verify taxonomic accuracy of processed samples -Voucher specimen tracking -Adherence to safety and SOP procedures by laboratory staff -Check data for completeness -Perform all necessary calculations on the data -Ensure that data are entered into the AIMS II Database -Ensure that required QA/QC are performed on the data -Querying data from AIMS II to determine results not meeting Water Quality Criteria	-IDEM 1992a, 1992e, 2004, 2010b, 2010c, 2012a -AIMS II Database User Guide
Laboratory Staff - Fish or Macroinvertebrate Community Sample Processing	-Complete hands-on training for laboratory sample processing methodology prior to participation in laboratory sample processing activities -Annually review relevant safety procedures -Annually review relevant SOP documents for laboratory operations	-Adhere to safety and SOP procedures -Follow Laboratory Supervisor direction while processing samples -Identification of fish and macroinvertebrate specimens collected during field sampling -Completion of laboratory data sheets, perform necessary calculations on data, enter field sheets	-IDEM 1992a, 1992e, 2004, 2010b, 2010c, 2012a -AIMS II Database User Guide
Laboratory Supervisor - Water Chemistry,	-Bachelor of Science Degree in biology or other closely related area	-Completion of laboratory data sheets -Adherence to safety and	-IDEM 2010b, 2010c, 2015a -AIMS II

Role	Required Training/Experience	Responsibilities	Training References
Algal and/or Bacteriological Sample Processing	-Annually review relevant safety procedures -Annually review relevant SOP documents for field operations	SOP procedures by laboratory staff -Check data for completeness -Perform all necessary calculations on the data -Ensure that data are entered into the AIMS Data Base -Ensure that required QA/QC are performed on the data -Querying data from AIMS II to determine results not meeting Water Quality Criteria	Database User Guide
Quality Assurance Officer	-Bachelor of Science in chemistry or a related field of study -Familiarity with QA/QC practices and methodologies -Familiarity with the WAPB QAPP and data qualification methodologies	-Ensure adherence to QA/QC requirements of WAPB QAPP -Evaluate data collected by sampling crews for adherence to project work plan -Review data collected by field sampling crews for completeness and accuracy -Perform a data quality analysis of data generated by the project - Assign data quality levels based on the data quality analysis -Import data into the AIMS data base -Ensure that field sampling methodology audits are completed according to WAPB procedures	-IDEM 2004, 2012a -U.S. EPA 2006 documentation on QAPP development and data qualification -AIMS II Database User Guide

II. MEASUREMENT/DATA ACQUISITION

Sampling Design and Site Locations

Sites are generated by the U.S. EPA, NHEERL, Western Ecology Division, in Corvallis, Oregon using Environmental Monitoring Assessment Program (EMAP) selection methods. The EMAP design uses a statistically valid number of randomly selected sites to assess and characterize the overall water quality and biotic integrity of the basin of study. To statistically estimate the percent of the basin attaining designated uses with a 95% confidence level, a minimum of 38 probabilistic sites will be sampled in the basin of interest. This minimum required number of sites was determined by analyzing fish community IBI metric scores from 317 sites sampled from 1996-2000 with the following formula:

$$n = \frac{s^2}{(p)^2(\bar{x})^2}$$

where $\boldsymbol{n}$ is the number of sites required, $\boldsymbol{s}$ is the sample standard deviation (10.98922), $\bar{\boldsymbol{x}}$ is the sample mean (35.52366), and $\boldsymbol{p}$ is the p-value (set at 0.05 for a 95% confidence level) (Elliott 1983). A sample size of 38 was thereby determined to be sufficient to arrive at the "true" average IBI score for a basin 95% of the time. This sample size was also found to be sufficient to provide 80% estimations for eight of the more frequently used individual metrics used in the calculation of the fish community IBI.

Site selection is stratified to ensure effort is equally distributed between stream orders for equal representation of the various stream sizes within the basin. IDEM's site selection process incorporates a stratified random probability design in order to select an approximately equal number of 1st, 2nd, 3rd, and 4th order and higher streams in the basin. Utilizing the stratification method ensures that a greater number of sampling sites on lesser order streams are not chosen based on proportion of stream miles. An overdraw of sampling sites is requested to compensate for denial of access, dry stream conditions, and sites presenting extremely difficult or unsafe access.

Site reconnaissance activities will be conducted in-house and through physical site visits. In-house activities will include preparation and review of site maps and aerial photographs, initial evaluation of target or non-target site status, potential access routes and initial property owner searches. Physical site visits will include property owner consultations, verification of site status (target or non-target), confirmation and documentation of access routes, and determination of equipment needed to properly sample the site. Precise coordinates for each approved target site will be determined using a Trimble Juno™ SB or Trimble Juno™ 3D handheld Series Global Positioning System (GPS) with an accuracy of 2-5 meters (IDEM 2015b). All 100 potential sites are to be visited at least once during site reconnaissance to determine target or non-target status (marsh, dry, backwater, etc.). However, landowner permission and site access will be determined for only the first 75 potential sites with the remaining 25 sites noted only as "Target" or "Non-Target". Analysis of previous seasons' reconnaissance and sampling results indicated that sites 75 through 100 (see Table 3) are rarely visited as the number of potential sites needed to obtain 45 approved sites is usually fewer than 75 (Tim Fields, IDEM OWQ, personal communication). After each site has been visited once, and at least 45 sites have been approved in the basin of interest, field work for site reconnaissance activities should be minimal. Although 8 weeks is the maximum time allotted for site reconnaissance field work (see Section I on PROJECT MANAGEMENT/PLANNING for site reconnaissance activities, QAPP ELEMENT A4), most work can be completed in a 6-week period (dependent upon weather, driving time to sites, and other unforeseeable constraints). The remaining work, if possible, can be done in the office with phone calls to seek landowner permission; if permission to visit a site is then granted before the 12 week deadline, a daytrip or overnight may be needed to determine access routes, equipment, and more accurate GPS coordinates. Once the deadline is reached, those sites that were not accessible through bridge right-of-way, yet appeared to be "target" from the nearest bridge, will be entered into the database with the Reconnaissance Decision as "No, Other" with the following text in the Comments field "Unable to contact landowner by deadline" along with the date and initials of the person entering the data and writing it on the IDEM Site Reconnaissance Form (Attachment 1).

Table 3 lists the potential sampling sites generated by U.S. EPA Corvallis for the Lower Wabash River Basin. Target sampling sites will be taken in sequential order as shown in Table 3 until the 45 sites are sampled for algal community and water chemistry, 40 sites for bacteriological sampling, and 38 sites for biological sampling programs. If a site is considered "non-target" (dry, backwater, marsh/wetland, etc.) or unavailable to sample for some other reason (physical barrier, landowner denial, etc.), the next target site on the list will be taken. Figure 1 depicts potential sampling sites generated by U.S. EPA Corvallis for this project and their approximate locations.

Sampling Methods and Sample Handling

Bacteriological Sampling

The bacteriological sampling will be conducted by one or two teams consisting of one or two staff. The work effort will require an average of one hour per site per week. Samples will be processed in an IDEM *E. coli* Mobile Laboratory (van) equipped with all materials and equipment necessary for the Colilert® *E. coli* Test Method (Standard Method 9223B) near the sampling sites. Five samples from each site (40 sites total) will be collected at equally spaced intervals over a thirty day period. Staff will collect the samples in a 120 mL pre-sterilized wide mouth container from the center of flow (if the stream is wadeable) or from the shoreline using a pole sampler (if the stream is not wadeable). This is subject to field staff determination based on available PPE, turbidity, and other factors; however, streams waist deep or shallower are generally considered wadeable. All samples will be consistently labeled, cooled, and held at a temperature less than 10ºC during transport. All *E. coli* samples will be collected on a schedule such that any sampling crew can deliver them to the IDEM *E. coli* Mobile Laboratory for analyses within the bacteriological holding time of six hours.

The IDEM *E. coli* Mobile Laboratory is used in this project to facilitate *E. coli* testing by eliminating the necessity of transporting samples to distant contract laboratories within a six-hour holding time. The *E. coli* Mobile Laboratory provides work space containing storage for samples, supplies for Colilert® Quanti-tray testing, and all equipment needed for collecting, preparing, incubating, and analyzing results. All supplies will be obtained from IDEXX Laboratories, Inc., Westbrook, Maine.

Water Chemistry Sampling

During three discrete sampling events, one team of two staff will collect grab water chemistry samples and record water chemistry field measurements and physical site descriptions on the IDEM Stream Sampling Field Data Sheet (Attachment 2). All water chemistry sampling will adhere to the Water Quality Surveys Section Field Procedure Manual (IDEM 2002, pp 8-14). Water chemistry sampling usually takes 30 minutes to complete for each site, depending on accessibility.

Algal Sampling

In addition to standard water chemistry sampling, one team of two staff will collect chlorophyll *a* and pheophytin *a* from the phytoplankton (seston) and periphyton communities during the third round of water chemistry in September and October (Table 1). Sampling for an average site that includes all of the above parameters will require approximately 2.5 hours of effort. The Algal Biomass Lab Datasheet (Attachment 3) and Probabilistic Monitoring Section Physical Description of Stream Site Form (Attachment 4) will be used to record information regarding substrates sampled for periphyton and physical parameters of the stream sampling area.

In order to obtain a representative algal community sample, collection must occur during low/base flow and not directly following a major precipitation event. Such an event is defined as a sudden rain event that quickly increases the stream flow above low/base flow. Stream flow conditions may be determined either by viewing recent data from USGS stream flow monitoring gages (available at http://waterdata.usgs.gov/nwis/rt) or by best professional judgment during a visit to the site. Following major weather events, sampling must be postponed for a week to allow the algal communities to return to a representative state.

Data analysis by the USGS indicated no correlation between phytoplankton chlorophyll *a* and effects on biological communities in headwater (drainage area of 52 km^2 or less) and wadeable (drainage area of 52 - 2590 km^2) streams (Caskey et al. 2013); therefore, phytoplankton samples

will only be collected in streams draining more than 2590 km^2 (1000 mi^2) to save resources, both in terms of sampling time and costs associated with chlorophyll *a* analysis. All phytoplankton samples will be collected along a transect in the stream using either the multiple vertical method (if flow >1.5 ft/s) or the grab sample method (IDEM 2016).

Periphyton samples will be collected from one of three substrate types (in order of preference): epilithic (rocks), epidendric (sticks), or episammic (sand). Rocks represent the most stable substrate, which more accurately reflects stream conditions from a specific site which is why they are given precedence over sticks and sand. Sand is the most frequently disturbed substrate and therefore least representative of a stable climax algal community. Sand is only collected if rocks and sticks are not present at a site (IDEM 2016).

Samples will be delivered to the USGS Indiana Algal Biomass Laboratory in Indianapolis and processed within 24 days of collection. Using U.S. EPA method 445.0, the laboratory will provide measurements for chlorophyll *a* and pheophytin *a* for both seston and periphyton samples.

Laboratory Procedures for Diatom Identification and Enumeration

See IDEM 2015a for a description of methods used in diatom identification and enumeration.

Fish Community Sampling

Fish community sampling will be performed using various standardized electrofishing methodologies depending on stream size and site accessibility. Fish assemblage assessments will be performed in a sampling reach of 15 times the average wetted width, with a minimum reach of 50 meters and a maximum reach of 500 meters (Simon DRAFT; Simon 2006; Simon and Dufour 1998, 2005; U.S. EPA 1995). An attempt will be made to sample all habitat types available within the sample reach to ensure adequate representation of the fish community present at the time of the sampling event. The possible list of electrofishers to be utilized include: the Smith-Root LR-24 or LR-20B Series backpack electrofishers; the Smith-Root model 1.5KVA electrofishing system; the Smith-Root model 2.5 Generator Powered Pulsator (GPP) electrofisher with RCB-6B junction box and rat-tail cathode cable, assembled in a canoe (if parts of the stream are not wadeable, the system may require the use of a dropper boom array outfitted in a canoe or possibly a 12 foot Loweline boat); or, for non-wadeable sites, the Smith-Root model 6a electrofisher assembled in a 16 foot Loweline boat (IDEM 1992a, 1992b, 1992c, 1992d).

Sample collections during high flow or turbid conditions will be avoided due to 1) low collection rates which result in non-representative samples and 2) safety considerations for the sampling team. Sample collection during late autumn will be avoided due to the cooling of water temperature, which may affect the responsiveness of some species to the electrical field. This lack of responsiveness can result in samples that are not representative of the stream's fish assemblage (Simon 1990; U.S. EPA 1995).

Fish will be collected using dipnets with fiberglass handles and netting of 1/8-inch bag mesh. Fish collected in the sampling reach will be sorted by species into baskets and/or buckets. Young-of-the-year fish less than 20 millimeters (mm) total length will not be retained in the community sample (Simon 1990; U.S. EPA 1995).

Prior to processing fish specimens and completion of the fish community datasheet, one to two individuals per species will be preserved in 3.7% formaldehyde solution for future reference if there are more than 10 individuals for that species collected in the sampling reach, the specimens can be positively identified, and the individuals for preservation are small enough to fit in a 2000 mL jar. If however, there are few individuals captured or the specimens are too large to preserve, a photo of key characteristics (e.g., fin shape, size, body coloration) will be taken for later examination (IDEM 2016, p. 8). Taxonomic characteristics for possible species encountered in the basin of interest will be reviewed prior to field work. Fish specimens should also be preserved

if they cannot be positively identified in the field (i.e., those that co-occur like the Striped and Common Shiners or are difficult to identify when immature), individuals that appear to be hybrids or have unusual anomalies, as well as dead specimens that are taxonomically valuable for un-described taxa (e.g., Red Shiner or Jade Darter), life history studies, or research projects.

Data will be recorded for non-preserved fish on the IDEM Fish Collection Data Sheet (Attachment 5) consisting of the following: number of individuals, minimum and maximum total length (mm), mass weight in grams (g), and number of individuals with deformities, eroded fins, lesions, tumors, and other anomalies (DELTs). Once the data have been recorded, specimens will be released within the sampling reach from which they were collected. Data will be recorded for preserved fish specimens following taxonomic identification in the laboratory.

Macroinvertebrate Sampling

Aquatic benthic macroinvertebrate samples are collected using a modification of the U.S. EPA Rapid Bioassessment Protocol multi-habitat (MHAB) approach using a D-frame dip net (Plafkin et al. 1989; Barbour et al. 1999; Klemm et al. 1990; IDEM 2010a). The IDEM MHAB approach (IDEM 2010a) is composed of a 1-minute “kick” sample within a riffle or run (collected by disturbing one square meter of stream bottom substrate in a riffle or run habitat and collecting the dislodged macroinvertebrates within the dipnet) and a 50 meter “sweep” sample of shoreline habitats (collected by disturbing habitats such as emergent vegetation, root wads, coarse particulate organic matter, depositional zones, logs and sticks and collecting the dislodged macroinvertebrates within the dipnet). The 50 meter length of riparian corridor that is sampled at each site will be defined using a tape measure or rangefinder. If the stream is too deep to wade, a boat will be used to sample the 50 meter zone along the shoreline that has the best available habitat. The 1-minute “kick” and 50 meter “sweep” samples are combined in a bucket of water which will be elutriated through a U.S. standard number 35 (500 µm) sieve a minimum of five times so that all rocks, gravel, sand and large pieces of organic debris are removed from the sample. The remaining sample is then transferred from the sieve to a white plastic tray where the collector (while still on-site) will conduct a 15-minute pick of macroinvertebrates at a single organism rate with an effort to pick for maximum organism diversity and relative abundance through turning and examination of the entire sample in the tray. The resulting picked sample will be preserved in 70% isopropyl alcohol and returned to the laboratory for identification at the lowest practical taxonomic level (usually genus or species level, if possible) and evaluated using the MHAB macroinvertebrate IBI. Before leaving the site, an IDEM OWQ Macroinvertebrate Header Form (Attachment 6) will be completed for the sample.

Habitat Assessments

Habitat assessments will be completed immediately following macroinvertebrate and fish community sample collections at each site using a slightly modified version of the Ohio Environmental Protection Agency (OHEPA) Qualitative Habitat Evaluation Index (QHEI), 2006 edition (Rankin 1995; OHEPA 2006). A separate QHEI (Attachment 7) must be completed for these two sample types since the sampling reach length may differ (i.e. 50 meters for macroinvertebrates and between 50 and 500 meters for fish).

Field Parameter Measurements

Dissolved oxygen, pH, water temperature, specific conductance, and dissolved oxygen percent saturation will be measured with a data sonde during each sampling event regardless of the sample type being collected. Measurement procedures and operation of the data sonde shall be performed according to the manufacturers’ manuals (Hydrolab Corporation 2002; YSI 2002) and Sections 2.10-2.13 of the Water Quality Surveys Section Field Procedure Manual (IDEM 2002, pp 67-79). Turbidity will be measured with a Hach turbidity kit, and the meter number written in the comments under the field parameter measurements. If a Hach turbidity kit is not available, the data sonde measurement for turbidity will be recorded. All field parameter measurements and

weather codes will be recorded on the IDEM Stream Sampling Field Data Sheet (Attachment 2) with other sampling observations. A digital photo will also be taken upstream and downstream of the site during each sampling event (IDEM 2016).

Analytical Methods

Table 6 lists the *E. coli* bacteriological and field parameters with their respective test method and IDEM quantification limits. Table 7 lists the algal parameters with test method and USGS quantification limits. Table 8 shows bacteriological and water chemistry sample container, preservative, and holding time requirements (all samples iced to 4 Degrees Celsius °C). Table 9 lists numerous parameters (priority metals, anions/physical, and nutrients/organic) with their respective test methods, IDEM reporting limits, and contract laboratory reporting limits. The IDEM OWQ Chain of Custody Form (Attachment 8) and the 2016 Corvallis Water Sample Analysis Request Form (Attachment 9) accompanies each sample set through the analytical process.

Diatoms will be collected in the field according to protocols described in Moulton et al. 2002 with a slight modification as mentioned in Section II. MEASUREMENT/DATA ACQUISITION (QAPP Elements B2, B3). See Appendix 4 in IDEM 2015a for a list of taxonomic references used in Diatom Identification and Enumeration.

Quality Control and Custody Requirements

Quality assurance protocols will follow part B5 of the WAPB QAPP (IDEM 2004, p 119).

Bacteriological Sampling

Bacteriological samples will be analyzed using the Standard Method (SM) 9223B Enzyme Substrate Coliform Test Method (see Table 6 for quantification limits). Samples will be collected using 120 mL pre-sterilized wide mouth containers and adhere to the six hour holding time (Table 8). Analytical results from the IDEM *E. coli* Mobile Laboratory include quality control (QC) check sample results from which precision, accuracy, and completeness can be determined for each batch of samples. Raw data are archived by analytical batch for easy retrieval and review. Chain of custody procedures must be followed, including: time of collection, time of setup, time of reading the results, and time and method of disposal. Any method deviations will be thoroughly documented in the field notes.

All QA/QC samples will be tested according to the following guidelines:

Field Duplicate:	Field Duplicates will be collected at a frequency of 1 per batch or at least 1 for every 20 samples collected (≥ 5%).
Field Blank:	Field Blanks will be collected at a frequency of 1 per batch or at least 1 for every 20 samples collected (≥ 5%).
Laboratory Blank:	Laboratory Blanks (sterile laboratory water blanks) will be tested at a frequency of 1 per day.
Positive Control:	Each lot of media will be tested for performance using bacterial cultures for positive *E. coli*.
Negative Controls:	Each lot of media will be tested for performance using bacterial cultures for total coliform other than *E. coli* and a noncoliform.

Quality assurance documentation for each batch of samples consists of a chain of custody form, a QA/QC summary sheet, and spreadsheets of results. This documentation is submitted to the

Technical and Logistical Services Section for QA review and the assignment of an appropriate Data Quality Assessment (DQA) Level.

Water Chemistry Data

Sample bottles and preservatives certified for purity will be used. Sample collection procedures, including: the container and preservative used for each parameter and holding times will adhere to U.S. EPA requirements for water chemistry testing (see Table 8). Field duplicates and matrix spike/matrix spike duplicates (MS/MSD) shall be collected at the rate of one per sample analysis set or one per every 20 samples, whichever is greater. Additionally, field blank samples using ASTM D1193-91 Type I water will be taken at a rate of one set per sampling crew for each week of sampling activity. All samples collected for water chemistry analysis will be processed by Pace Analytical Services, Inc. (Indianapolis, Indiana) following the specifications set forth in Request For Proposals 12-48 (IDEM 2012b).

Table 6. Bacteriological and Field Parameters showing method and IDEM quantification limit.

Parameters	Method (SM=Standard Method)	IDEM Quantification Limit
E. coli (Enzyme Substrate Coliform Test)	SM 9223B	1 MPN [1] / 100 mL
Dissolved Oxygen (data sonde optical)	ASTM D888-09	0.05 mg/L
Dissolved Oxygen (data sonde)	SM 4500-OG	0.03 mg/L
Dissolved Oxygen (Winkler Titration)	SM 4500-OC [2]	0.20 mg/L
Dissolved Oxygen % Saturation (data sonde optical)	ASTM D888-09	0.05 %
Dissolved Oxygen % Saturation (data sonde)	SM 4500-OG	0.01 %
pH (data sonde)	U.S. EPA 150.2	0.10 S.U.
pH (field pH meter)	SM 4500H-B [2]	0.10 S.U.
Specific Conductance (data sonde)	SM 2510B	1.00 µmhos/cm
Temperature (data sonde)	SM 2550B(2)	0.1 Degrees Celsius (°C)
Temperature (field meter)	SM 2550B(2) [2]	0.1 Degrees Celsius (°C)
Turbidity (data sonde)	SM 2130B	0.02 NTU [3]
Turbidity (Hach™ turbidity kit)	U.S. EPA 180.1	0.05 NTU [3]

[1] 1 MPN (Most Probable Number) = 1 CFU (Colony Forming Unit)
[2] Method used for Field Calibration Check
[3] NTU = Nephelometric Turbidity Unit(s)

Table 7. Algal Parameters showing method and USGS quantification limit.

Algal Parameter	Method	USGS Quantification Limit
Seston Chlorophyll *a* - Suspended	U.S. EPA 445.0	0.30 µg/L
Seston Pheophytin *a* - Suspended	U.S. EPA 445.0	0.30 µg/L
Periphyton Chlorophyll *a* - Attached	U.S. EPA 445.0	0.30 µg/m^2
Periphyton Pheophytin *a* - Attached	U.S. EPA 445.0	0.30 µg/m^2

Table 8. Bacteriological and Water Chemistry Sample Container, Preservative, and Holding Time Requirements[1]

Parameter	Container	Preservative	Holding Time
[1]Alkalinity as $CaCO_3$*	1 L, plastic, narrow mouth	None	14 days
[2]Ammonia-N**	1 L, plastic, narrow mouth	H_2SO_4 < pH 2	28 days
Chloride*	1 L, plastic, narrow mouth	None	28 days
Chemical Oxygen Demand**	1 L, plastic, narrow mouth	H_2SO_4 < pH 2	28 days
Cyanide (All forms)	1 L, plastic, narrow mouth	NaOH > pH 12	14 days
E. coli	120 mL, pre-sterilized, wide mouth	$Na_2S_2O_3$	6 hours
Hardness (as $CaCO_3$*) Calculated	1 L, plastic, narrow mouth	HNO_3 < pH 2	6 months
Metals (Total & Dissolved)	1 L, plastic, narrow mouth	HNO_3 < pH 2	6 months
Nitrate + Nitrite-N**	1 L, plastic, narrow mouth	H_2SO_4 < pH 2	28 days
Total Phosphorus**	1 L, plastic, narrow mouth	H_2SO_4 < pH 2	28 days
Solids (All Forms)*	1 L, plastic, narrow mouth	None	7 days
Sulfate*	1 L, plastic, narrow mouth	None	28 days
Total Kjeldahl Nitrogen**	1 L, plastic, narrow mouth	H_2SO_4 < pH 2	28 days
Total Organic Carbon**	1 L, plastic, narrow mouth	H_2SO_4 < pH 2	28 days

[1]All samples iced to 4°C
[2]General chemistry includes all parameters noted with an *
[3]Nutrients include all parameters noted with a **

Table 9. Water Chemistry Parameters with Test Method and IDEM and Laboratory Reporting Limits.

Priority Metals					
Parameter	Total	Dissolved	Test Method	IDEM-requested Reporting Limit (µg/L)	Pace Laboratory Reporting Limit (µg/L)
Aluminum	☒	☒	U.S. EPA 200.7	150	20
Antimony	☒	☒	U.S. EPA 200.8	1	0.5
Arsenic	☒	☒	U.S. EPA 200.8	5	2.5
Calcium	☒	☐	U.S. EPA 200.7	40	40
Cadmium	☒	☒	U.S. EPA 200.8	2	1
Chromium	☒	☒	U.S. EPA 200.8	3	1.5
Copper	☒	☒	U.S. EPA 200.8	2	1
Lead	☒	☒	U.S. EPA 200.8	2	1
Magnesium	☒	☐	U.S. EPA 200.7	95	100
Nickel	☒	☒	U.S. EPA 200.8	1.5	0.75
Selenium	☒	☒	U.S. EPA 200.8	4	2
Silver	☒	☒	U.S. EPA 200.8	0.3	0.3
Zinc	☒	☒	U.S. EPA 200.8	6	6

Anions/Physical			
Parameter	Pace Test Method	IDEM-requested Reporting Limit (mg/L)	Pace Laboratory Reporting Limit (mg/L)
Alkalinity (as CaCO3)	U.S. EPA 310.2	10	10
Total Solids	SM 2540B	1	10
Total Suspended Solids	SM 2540D	1	1
Dissolved Solids	SM 2540C	10	10
Sulfate	U.S. EPA 300.0	0.05	0.35
Chloride	U.S. EPA 300.0	1	1
Hardness (as CaCO3) by calculation	SM 2340B	0.4	1

Nutrients/Organic			
Parameter	Pace Test Method	IDEM-requested Reporting Limit (mg/L)	Pace Laboratory Reporting Limit (mg/L)
TKN	SM 4500N(Org)	0.03	0.3
Ammonia-N	SM 4500NH3-G	0.01	0.1
Nitrate+Nitrite-N	U.S. EPA 353.2	0.05	0.01
Total Phosphorus	U.S. EPA 365.1	0.01	0.05
Total Organic Carbon (TOC)	SM 5310C	1	1
Cyanide-Total	U.S. EPA 335.4	0.01	0.005
Cyanide-Weak Acid Dissociable	SM 4500CN-I	0.01	0.005
Chemical Oxygen Demand (COD)	U.S. EPA 410.4	3	10

Org: Organic
SM: Standard Methods for the Analysis of Drinking Water and Wastewater
TKN: Total Kjeldahl Nitrogen
U.S. EPA: United States Environmental Protection Agency

Algal Community Data

Excessive algal conditions will be recorded by staff if an algal bloom is observed on the water's surface or in the water column. Staff are not calibrated on this rating (i.e. the decision as to the severity of the bloom is based on best professional judgement), but an algal mat on the surface of the water or a bloom that gives the water the appearance of green paint would be justification for a decision of excessive algal conditions. To decrease the potential for cross contamination and bias of the algal samples, all equipment that has come in contact with the sample will be cleaned with detergent and rinsed with ASTM D1193-91 Type III water after sampling has been completed at a given site. All sample labels must be accurately and thoroughly completed, including AIMS II sample numbers, date, stream name, and sampling location. Chain of Custody forms will be completed in the field to document the collection and transfer of samples to the laboratory. Upon arrival to the laboratory, samples will be checked in by the laboratory manager. For the diatom samples, there will be another Chain of Custody form to document when the sample is removed from storage to be processed and made into a permanent mount.

Methods and quantification limits for chlorophyll *a* and pheophytin *a* can be viewed in Table 7. All samples collected for chlorophyll *a* and pheophytin *a* determination will be processed by the USGS Indiana Algal Biomass Laboratory (Indianapolis, Indiana) following the specifications set in Joint Funding Agreement EDS# A305-3-109 (IDEM 2013) and amendment (IDEM 2015c). Blank filters will be run for periphyton and seston chlorophyll *a*. All chlorophyll *a* and pheophytin *a* filters will be processed in quadruplicate for QC purposes (four filters are processed from the same sample). Ten percent of these replicate field samples will be analyzed at the USGS National Water Quality Laboratory in Arvada, Colorado.

Quality control of the diatom sampling, enumeration, and identification project will be documented by QC checks of both field and laboratory data. See IDEM 2015a for description of quality assurance/ quality control protocols used in Diatom Identification and Enumeration. Ten percent of diatom samples will be verified by the Department of Biological and Environmental Sciences of Georgia College and State University (Milledgeville, Georgia) following the specifications set forth in IDEM 2015a and IDEM 2014c.

Fish Community Data

Replicate fish community sampling will be performed at a rate of 10 percent of the total fish community sites sampled, approximately 4 in the basin (IDEM 1992a; U.S. EPA 1995). Replicate sampling will be performed with at least 2 weeks of recovery between the initial and replicate sampling events. The fish community replicate sampling and habitat assessment will be performed with either a partial or complete change in field team members (U.S. EPA 1994; U.S. EPA 1995). The resulting IBI and QHEI total score between the initial visit and the revisit will be used to evaluate precision. The IDEM OWQ Chain of Custody Form is used to track samples from the field to the laboratory (Attachment 8). Fish taxonomic identifications made by IDEM staff in the laboratory may be verified by regionally recognized non-IDEM freshwater fish taxonomists (e.g., Brant Fisher, Nongame Aquatic Biologist, Indiana DNR). All raw data are: 1) checked for completeness; 2) utilized to calculate derived data (i.e. total weight of all specimens of a taxon), which is entered into the AIMS II database; and 3) checked again for data entry errors.

Macroinvertebrate Community Data

Replicate macroinvertebrate field samples will be collected at a rate of 10 percent of the total macroinvertebrate community sites sampled, approximately 4 in the basin. The macroinvertebrate community replicate sample and habitat assessment will be performed by the same team member who performed the original sample, immediately after the initial sample is collected. This will result in a precision evaluation based on a 10% replicate of samples collected. The IDEM OWQ Chain of Custody Form is used to track samples from the field to the laboratory

(Attachment 8). Laboratory identifications and QA/QC of taxonomic work is maintained by the laboratory supervisor of the Probabilistic Monitoring Section of IDEM.

Field Parameter Measurements/Instrument Testing/Calibration

The data sonde will be calibrated immediately prior to each week's sampling (IDEM 2002). The dissolved oxygen component of the calibration procedure will be conducted using the air calibration method. Calibration results and drift values will be recorded, maintained, stored, and archived in the calibration laboratories at the Shadeland facility. The drift value is the difference between two successive calibrations. Field parameter calibrations will conform to the procedures described in the instrument users manuals (Hydrolab Corporation 2002; YSI 2002). The unit will be field checked for accuracy once during the week by comparison with a Winkler dissolved oxygen test (IDEM 2002, page 64), as well as Hach turbidity, pH and temperature meters. Weekly field calibration records will be recorded in the field calibrations portion of Attachment 2 and entered into the AIMS II database. A Winkler dissolved oxygen test will also be conducted in the field at sites where the dissolved oxygen concentration is 4.0 mg/L or less.

Field Analysis Data

In-situ water chemistry field data are collected in the field using calibrated or standardized equipment. Calculations may be done in the field or later at the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges have been set for each analysis. Quality control checks are performed on information for field or laboratory results to estimate precision, accuracy, and completeness for the project as described in the WAPB QAPP (IDEM 2004) Section C1.1 on page 124.

Algal Community Data

Equipment required for the collection of periphyton include: a toothbrush, cloth measuring tape, petri dish top, spatula, stencil brush, small hobby knife with a chisel blade, a dissection probe, a modified syringe with a rubber o-ring attached, Nalgene HDPE plastic 250 mL sample bottles, plastic bins, and a unitary wash bottle filled with tap water. None of this equipment requires calibration. Equipment has been field tested to ensure its capability of appropriately removing periphyton from different types of substrate (rocks, sticks, sand/silt).

Laboratory equipment that will be used for the preparation of permanent diatom mounts include: hot plate, fume hood, centrifuge, glass beakers, centrifuge tubes, glass microscope slides, microscope cover glasses, micropipetter, and micropipetter tips. The micropipetter was purchased new and came with a calibration certificate as proof that it was calibrated at the factory. Other than the micropipetter, none of the laboratory equipment requires calibration. The micropipetter will be checked and recalibrated as necessary according to manufacturer's specifications.

A Nikon differential interference contrast (DIC) microscope and Nikon Elements D camera and imaging system will be used for identification and enumeration of diatoms. Branch staff calibrated the ocular reticle in the microscope. The ocular reticle was calibrated at each magnification with a stage micrometer. The calibration should be checked again if the microscope is moved to a new location.

III. ASSESSMENT/OVERSIGHT

Field and laboratory performance and system audits will be conducted to ensure good quality data. The field and laboratory performance checks include precision measurements by relative percent difference (RPD) of field and laboratory duplicate (IDEM 2004, pp. 41, 45-46), accuracy measurements by percent of recovery of matrix spike and matrix spike duplicate (MS/MSD)

samples analyzed in the laboratory (IDEM 2004, pp. 43, 45-46), and completeness measurements by the percent of planned samples that are actually collected, analyzed, reported, and usable for the project (IDEM 2004, p. 43).

Field audits will be conducted to ensure that sampling activities adhere to approved SOPs. Audits are systematically conducted by WAPB Quality Assurance staff to include all WAPB personnel that engage in field sampling activities. WAPB field staff involved with sample collection and preparation will be evaluated by QA staff trained in the associated sampling SOPs, and in the processes related to conducting an audit. QA staff will produce an evaluation report documenting each audit for review by those field staff audited, as well as WAPB management. Corrective actions will be communicated to, and implemented by, field staff as a result of the audit process (IDEM 2004, p. 126).

Data Quality Assessment Levels
The samples and various types of data collected by this program are intended to meet the quality assurance criteria and rated DQA Level 3, as described in the WAPB QAPP (IDEM 2004, pp. 128-129).

IV. DATA VALIDATION AND USABILITY

Quality assurance reports to management and data validation and usability are also important components of the QAPP which ensures good quality data for this project. A quality assurance audit report will be submitted to the QA Manager and Project Manager for review for this project should problems arise and need to be investigated and corrected. Data are reduced (converted from raw analytical data into final results in proper reporting units), validated (qualified based on the performance of field and laboratory QC measures incorporated into the sampling and analysis procedures), and reported (described so as to completely document the calibration, analysis, QC measures, and calculations). These steps allow users to assess the data to ensure it meets the project data quality objectives.

Quality Assurance/Data Qualifiers and Flags

The various data qualifiers and flags that will be used for quality assurance and validation of the data are found on pages 130-131 of the WAPB QAPP (IDEM 2004).

Data Usability

The environmental data collected and its usability are qualified per each lab and/or field result obtained and classified into one or more of the four categories: Acceptable Data, Enforcement Capable Results, Estimated Data, and Rejected Data as described on page 130 of the WAPB QAPP (IDEM 2004).

Information, Data, and Reports

Data collected in 2016 will be recorded in the AIMS II database and presented in three compilation summaries. The first summary will be a general compilation of the 2016 Lower Wabash River Basin field and water chemistry data prepared for use in the Indiana Integrated Water Monitoring and Assessment Report. The second summary will be in database report format containing biological results and habitat evaluations, which will be produced for inclusion in the Integrated Report as well as individual site folders. All site folders are maintained at the WAPB facility. The third summary will include diatom species taxa names and enumerations on laboratory bench sheets. Using U.S. EPA's spsurvey package, written in the "R" programing language (R Core Team 2014), the percent of perennial stream miles in the basin that support or do not support aquatic life and recreational uses will be made following use attainment decisions

for each site sampled. All data and reports will be made available to public and private entities which may find the data useful for municipal, industrial, agricultural, and recreational decision making processes (TMDL, NPDES permit modeling, Watershed Restoration Projects, Water Quality Criteria refinement, etc.).

Laboratory and Estimated Cost

Laboratory analysis and data reporting for this project will comply with the QAPP for Indiana Surface Water Quality Monitoring and TMDL Program (IDEM/100/29/338/073/2004, see IDEM 2004), Request For Proposals 12-48 (see IDEM 2012b), and the Office of Water Quality Assessment Branch Quality Management Plan (B-001-OWQ-A-00-08-R00, see IDEM 2012a). Analytical tests on the water chemistry parameters outlined in Table 9 will be performed by Pace Analytical Services (formerly Heritage Environmental) in Indianapolis, Indiana. Accreditation related to Pace Indy is included as Appendix 2. Supplies for the bacteriological sampling will come from IDEXX Laboratories, Inc., Westbrook, Maine. Algal samples will be collected by IDEM staff. Chlorophyll *a* and pheophytin *a* will be analyzed by the USGS Indiana Algal Biomass Laboratory in Indianapolis, Indiana. Diatom identification and enumeration will be performed by IDEM staff and/or an outside contractor. The Department of Biological and Environmental Sciences, Georgia College and State University will be verifying diatom taxa from ten percent of the sites sampled. All fish and macroinvertebrate samples will be collected and analyzed by IDEM staff. The anticipated budget for laboratory cost for the project is outlined in Table 10.

Table 10. Total Estimated Laboratory Cost for the Project.

Analysis	Number of Samples Collected	Laboratory	Estimated Cost
Water Chemistry	3 times @ 45 sites + 5 duplicates (1 per sample week) = 150 samples	Pace Analytical Services (formerly Heritage Environmental) 7726 Moller Road. Indianapolis, Indiana 46268	$57,200
Bacteriological (*E. coli)*	5 times @ 40 sites + 10 blanks + 10 duplicates = 220 samples	IDEM Mobile Laboratory Supplies IDEXX Laboratories, Inc. One IDEXX Drive Westbrook, Maine 04092	$1,100
Algal Biomass	1 time @ 45 sites + 5 duplicates (1 per sample week) = 50 samples	USGS Indiana Algal Biomass Laboratory 5957 Lakeside Blvd. Indianapolis, Indiana 46278	$12,500
Diatom Verification	1 time @ 45 sites + 5 duplicates (1 per sample week) = 50 samples 5 samples (10%) sent off for verification	Department of Biological and Environmental Sciences Georgia College and State University 320 S. Wayne St. Milledgeville, GA 31061	$1500
		Total	$72,300

Table 11. Personnel Safety and Reference Manuals

Role	Required Training/Experience	Training References	Training Notes
All Staff that Participate in Field Activities	-Basic First Aid and Cardio-Pulmonary Resuscitation (CPR)	-A minimum of 4 hours of in-service training provided by WAPB (IDEM 2010b)	-Staff lacking 4 hours of in-service training or appropriate certification will be accompanied in the field at all times by WAPB staff that meet Health and Safety Training requirements
	-Personal Protective Equipment (PPE) Policy	-IDEM 2008	
	-Personal Flotation Devices (PFD)	-February 29, 2000 WAPB internal memorandum regarding use of approved PFDs	-When working on boundary waters as defined by Indiana Code (IC) 14-8-2-27 or between sunset and sunrise on any waters of the state, all personnel in the watercraft must wear a high intensity

Role	Required Training/Experience	Training References	Training Notes
			whistle and Safety of Life at Sea (SOLAS) certified strobe light.

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Leanne Whitesell	IDEM/OWQ/WAPB/Watershed Planning and Restoration Section

Attachment 1. IDEM Site Reconnaissance Form.

IDEM

Site Reconnaissance Form

EPA Site Identifier	Rank
Recon #: Trip #:	

Site Number: Stream: County:

Location Description:

Reconnaissance Data Collected

Recon Date | Crew Members

Avg. Width (m) | Avg. Depth (m) | Max. Depth (m) | Nearest Town

Water Present? ☐ | Site Wadeable? ☐ | Riffle/Run Present? ☐ | Road/Public Access Possible? ☐

Site Impacted by Livestock? ☐ | Collect Sediment? ☐ | Gauge Present? ☐

Landowner/Contact Information

First Name | Last Name

Street Address

City | State | Zip

Telephone | E-Mail Address

Pamphlet Distributed? ☐ | Please Call in Advance? ☐ | Results Requested? ☐

Rating, Results, Comments, and Planning

Site Rating By Category (1=easy, 10=difficult)
Access Route
Safety Factor
Sampling Effort

Reconnaissance Decision

Pre-Recon
Recon in process
Approved Site
No, Landowner denied access
No, Dry
No, Stream channel missing
No, Physical barriers
No, Impounded stream
No, Marsh/Wetland
No, Bridge gone or not accessible
No, Unsafe due to traffic or location
No, Site impacted by backwater
No, Other

Equipment Selected

Circle Equipment Needed

Backpack
Boat
Towbarge
Longline
Scanoe
Seine
Weighted Handline
Waders
Gill Net

Comments

Sketch of Stream & Access Route – Indicate Flow, Direction, Obstacles, & Land Use (Use Back of Page, if Necessary)

Attachment 2. IDEM Stream Sampling Field Data Sheet.

IDEM Stream Sampling Field Data Sheet

Analysis Set #	EPA Site ID	Rank

Sample #	Site #	Sample Medium	Sample Type	Duplicate Sample #

Stream Name: | River Mile: | County:

Site Description:

Survey Crew Chief	Sample Collectors 1	2	3	4	Sample Collected Date	Time	Hydrolab #	Water Depth/Gage Ht (ft)	Water Flow (cf/sec)	Flow Estimated?	Algae?	Aquatic Life?
										☐	☐	☐

Sample Taken?	Aliquots	Water Flow Type	Water Appearance	Canopy Closed %
☐ Yes ☐ No; Frozen	☐ 1 ☐ 2 ☐ 3 ☐ 4	☐ Riffle ☐ Dry ☐ Stagnant	☐ Clear ☐ Green ☐ Sheen	☐ 0-20% ☐ 60-80%
☐ No; Stream Dry ☐ No; Other	☐ 8 ☐ 8 ☐ 12 ☐ 24	☐ Pool ☐ Run ☐ Flood	☐ Murky ☐ Black ☐ Other	☐ 20-40% ☐ 80-100%
☐ No; Owner refused Access	☐ 48 ☐ 72 ☐ AS-Flow	☐ Glide ☐ Eddy ☐ Other	☐ Brown ☐ Gray (Septic/Sewage)	☐ 40-60%

Special Notes:

Field Data:

Date (m/d/yy)	24-hr Time (hh:mm)	D.O. (mg/l)	pH	Water Temp (°C)	Spec Cond (µohms/cm)	Turbidity (NTU)	% Sat.	Chlorine (mg/l)	Chloride (mg/l)	Chlorophyll (mg/l)	Weather Codes SC	WD	WS	AT
Comments														
Comments														
Comments														
Comments														
Comments														
Comments														

Measurement Flags	
<	< Min. Meter Measurement
>	> Max. Meter Measurement
E	Estimated (See Comments)
R	Rejected (See Comments)

Weather Code Definitions

SC Sky Conditions		WD Wind Direction	WS Wind Strength	AT Air Temp
1 Clear	8 Rain	00 North (0 degrees)	0 Calm	1 < 32
2 Scattered	9 Snow	09 East (90 degrees)	1 Light	2 33-45
3 Partly	10 Sleet	18 South (180 degrees)	2 Mod./Light	3 46-60
4 Cloudy		27 West (270 degrees)	3 Moderate	4 61-75
5 Mist			4 Mod./Strong	5 76-85
6 Fog			5 Strong	6 > 86
7 Shower			6 Gale	

Field Calibrations:

Date (m/d/yy)	Time (hh:mm)	Calibrator Initials	Calibrations Type	Meter #	Value	Units

Calibration Type
pH
DO
Turbidity

Preservatives/Bottle Lots:

Group: Preservative	Preservative Lot #	Bottle Type	Bottle Lot #

Groups: Preservatives		Bottle Types	
GC	General Chemistry: Ice	2000P	2000mL Plastic, Narrow Mouth
Nx	Nutrients: H2SO4	1000P	1000mL Plastic, Narrow Mouth
Metals	Metals: HNO3	500P	500mL Plastic, Narrow Mouth
CN	Cyanide: NaOH	250P	250mL Plastic, Narrow Mouth
O&G	Oil & Grease: H2SO4	1000G	1000mL Glass, Narrow Mouth
Toxics	Toxics: Ice	500G	500mL Glass, Wide Mouth
EcoII	Bacteriology: Ice	250G	250mL Glass, Wide Mouth
VOA	Volatile Organics: HCl & Thiosulfate	125G	125mL Glass, Wide Mouth
Pest	Pesticides: Ice	40GV	40mL Glass Vial
Phen	Phenols: H2SO4	120PB	120ml Plastic (Bacteria Only)
Sed	Sediment: Ice	1000PF	1000mL Plastic, Corning Filter
Gly	Glyphosate: Thiosulfate	500PF	500mL Plastic, Corning Filter
Hg	Mercury(1631): HCl	60P	60mL Plastic
CrS	Chromium VI(1636): NaOH	250T	250mL Teflon
MeHg	Methyl Mercury(1630): HCl	500T	500mL Teflon
		125T	125mL Teflon

Data Entered By: _____ QC1: _____
QC2: _____

Stream Sampling Field Data Sheet

Attachment 3. IDEM Algal Biomass Lab Data Sheet.

Algal Biomass Lab Datasheet

Sample #	Site	Stream

Supporting Site Information

Traditional Forestry % Closed Canopy: ☐ <=10m ☐ >10m (Measure center only if width <=10m, record to nearest whole percent)

	North	East	South	West	Average x 1.04 =
Left Bank					
Center					
Right Bank					
Total %CC (Average from above, or Center only = %CC)				100 - %CC	

Phytoplankton Information

Sampling Method: ☐ Grab Sample (Dip) ☐ Multiple Verticles Number of Verticles:

Chlorphyll A	Blank	Filter 1	Filter 2	Filter 3	Filter 4
Sample Time					
Sample Volume (mL)					

Periphyton Information

Periphyton Habitat: ☐ Epilithic (Area-Scape) ☐ Epidendric (Cylinder Scrape) ☐ Epipsammic (Petri Dish)

Diatom Sample Collected: ☐ Yes ☐ No | Diatom Volume: mL | Formalin Volume: mL | Slurry Volume mL

Chlorphyll A	Blank	Filter 1	Filter 2	Filter 3	Filter 4
Sample Time					
Sample Volume (mL)					

Periphyton Area Calculation

Cylinder Scrape

Snag #	Length (cm)(L)	Circumference U_1	U_2	U_3	U	Area (L * U)
1						
2						
3						
4						
5						
				Total Area (cm²)		

Area Scrape (Using SG-92)

Rock#	1	2	3	4	5
Area (cm²)	7.38	7.38	7.38	7.38	7.38
Total (cm²)	36.9				

Petri Dish

Number of Discrete Samples (n):	
Total Area of One Sampler (a):	19.01 cm²
Total Sample Area (n * a):	

Stream Discharge / Rainfall Information

Nearest USGS Gage Site: ☐ Upstream ☐ Downstream ☐ No USGS Gage Near

River miles from site:	Discharge CFS at sampling: CFS
Gage location:	Discharge days since 50% flow exceeded: days
Rainfall data source: ☐ NOAA ☐ CoCoRaHS ☐ Indiana State Climate Office ☐ USGS gage rain gauge ☐ Other:	
Total precipitation at sampling: in. on date:	Cumulative rain 7 days previous to sampling: in.
	Inches since last rainfall previous to sampling: in.
Rain station location, county:	Days since last rainfall previous to sampling: days

Identifier	Date	Reviewer 1	Date	Reviewer 2	Date	Notes:
		☐ Review 1 Completed		☐ Review 2 Completed		

Attachment 4. IDEM Physical Description of Stream Site Form (front).

Revised 4/20/12

Probabilistic Monitoring Section Physical Description of Stream Site

Stream :_____ **AIMS #**_____**Program #:**_____

Date: _____ **Time:** _____ **Crew Chief:**_____**Crew**_____

General Stream Description:

_____
_____
_____
_____
_____

Characteristics at the site and immediately upstream (check All that apply).

Outer Riparian Zone L R	Inner Riparian Zone L R	L.Width(m)	R.Width(m)
☐ ☐ Agricultural Row crop	☐ ☐ Agricultural Rowcrop	_____	_____
☐ ☐ Agricultural Pasture	☐ ☐ Agricultural Pasture	_____	_____
☐ ☐ Devoid of Vegetation	☐ ☐ Devoid of Vegetation	_____	_____
☐ ☐ Fallow	☐ ☐ Fallow	_____	_____
☐ ☐ Forested	☐ ☐ Forest	_____	_____
☐ ☐ Residential	☐ ☐ Residential	_____	_____
☐ ☐ Commercial/Industrial	☐ ☐ Commercial/Industrial	_____	_____
☐ ☐ Weeds and Scrub	☐ ☐ Treeline	_____	_____
☐ ☐ Other _____	☐ ☐ Weeds and Scrub		
	☐ ☐ Other _____	_____	_____

Flow above site	Flow at site	Substrate (if visable)
☐ Riffle	☐ Riffle	☐ Cobble
☐ Pool	☐ Pool	☐ Boulder
☐ Eddy	☐ Eddy	☐ Sand
☐ Run	☐ Run	☐ Muck
☐ Glide	☐ Glide	☐ Silt
☐ Other _____	☐ Other _____	☐ Gravel
_____	_____	☐ Bedrock
_____	_____	☐ Other _____

Characteristics at site and immediately upstream (check ONE).

Water Description	Sinuosity of Channel	Discharge Pipe Present
☐ Clear	☐ High	☐ No
☐ Grey (Septic)	☐ Moderate	☐ Yes
☐ Murky	☐ Low	If yes, Effluent Flowing?
☐ Black	☐ Channelized	☐ No
☐ Brown		☐ Yes
☐ Green		Description of Effluent _____
☐ Other _____		_____

Continued on back

Attachment 4. IDEM Physical Description of Stream Site Form (back).

Revised 4/20/12

Stream Bank

Functional Slope: L R	Bank Erosion: L R	
☐☐ 0-30°	☐☐ Low	Percent Canopy Closed: _____
☐☐ 31-50°	☐☐ Moderate	
☐☐ 51-70°	☐☐ High	Stream Stage 1-5 (Low-High): _____
☐☐ 71-90°		Velocity of Stream 1-5 (Slow-Fast): _____

Visible Stream Degradation? ☐ Yes ☐ No

Description:_____

Aquatic Life Observed? ☐ Yes ☐ No

Description: _____

Algae Observed? ☐ Yes ☐ No

Description: _____

Rooted Macrophytes Observed? ☐ Yes ☐ No

Description: _____

Additional Comments:

_____
_____
_____
_____

Follow Up Date:_____Time:_____Crew Chief:_____Crew:_____
_____
_____
_____
_____

Follow Up Date:_____Time:_____Crew Chief:_____Crew:_____
_____
_____
_____
_____

Photography Date:_____ Time:_____ Number(s):_____; _____;_____

Notes (include items relevant for determining scale – items of known measurement, etc.)
_____
_____
_____

Attachment 5. IDEM Fish Collection Data Sheet (front).

IDEM
OWQ-WATERSHED ASSESSMENT AND PLANNING BRANCH

Event ID_____ Voucher jars_____ Unknown jars_____ Equipment_____ Page _____ of _____
Voltage_____ Time fished (sec)_____ Distance fished (m)_____ Max. depth (m)_____ Avg. depth (m)_____
Avg. width (m)_____ Bridge in reach_____ Is reach representative_____ If no, why_____
Elapsed time at site (hh:mm)____:____ Comments_____

Museum data: Initials_____ ID date_____ Jar count_____ Fish Total_____

Coding for Anomalies: D – deformities E – eroded fins L – lesions T – tumor M – multiple DELT anomalies O – other (A – anchor worm C – leeches W – swirled scales Y – popeye S – emaciated F – fungus P – parasites) H – heavy L – light (these codes may be combined with above codes)

TOTAL # OF FISH	WEIGHT (s) (mass g)	(length mm)	ANOMALIES
		Min length	D E L T M O
		Max length	
V P			
		Min length	D E L T M O
		Max length	
V P			
		Min length	D E L T M O
		Max length	
V P			
		Min length	D E L T M O
		Max length	
V P			
		Min length	D E L T M O
		Max length	
V P			
		Min length	D E L T M O
		Max length	
V P			

MKM: Rev/February 19, 2014

Attachment 5. IDEM Fish Collection Data Sheet (back).

Event ID______________ Page _____ of ______

								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												

MKM: Rev/February 19, 2014

Attachment 6. IDEM OWQ Macroinvertebrate Header Form.

Office of Water Quality: Macroinvertebrate Header

L-Site #	Event ID	Stream Name	Location	County	Surveyor

Sample Date	Sample #	Macro#	# Containers

☐ Habitat Complete ☐ Sample Quality Rejected

Macro Sample Type:
☐ Black Light ☐ Kick
☐ CPOM ☐ MHAB
☐ Hester-Dendy ☐ Qualitative

☐ Normal _____
☐ Duplicate _____
☐ Replicate _____

Riparian Zone/Instream Features

Watershed Erosion:
☐ Heavy
☐ Moderate
☐ None

Watershed NPS Pollution:
☐ No Evidence
☐ Obvious Sources
☐ Some Potential Sources

Stream Depth Riffle (m):	Stream Depth Run (m):	Stream Depth Pool (m):	Distances Riffle-Riffle (m):	Distances Bend-Bend (m):

Stream Width (m):	High Water Mark (m):	Velocity (ft/s):

Stream Type:
☐ Cold
☐ Warm

Turbidity (Est):
☐ Clear ☐ Slightly Turbid
☐ Opaque ☐ Turbid

Salinity (mg/L): _____

ORP (mV): _____

☐ Channelization ☐ Dam Present

Predominant Surrounding Land Use: ☐ Forest ☐ Field/Pasture ☐ Agricultural ☐ Residential ☐ Commercial ☐ Industrial
Other _____

Sediment

Sediment Odors: ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None Other _____

Sediment Deposits: ☐ Sludge ☐ Sawdust ☐ Paper Fiber ☐ Sand ☐ Relic Shells Other _____

Sediment Oils: ☐ Absent ☐ Moderate ☐ Profuse ☐ Slight

☐ Are the undersides of stones, which are not deeply embedded, black?

Substrate Components

(Note: Select from 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, or 100% for each inorganic/ organic substrate component)

Inorganic Substrate Components (% Diameter)						
Bedrock	Boulder (>10 in)	Cobble (2.5-10 in)	Gravel (0.1-2.5 in)	Sand (gritty)	Silt	Clay (slick)

Organic Substrate Components (% Type)			
Detritus (sticks, wood)	Detritus (CPOM)	Muck/Mud (black, fine FPOM)	Marl(gray w/ shell fragments)

Water Quality

Water Odors: ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ None Other _____

Water Surface Oils: ☐ Slick ☐ Sheen ☐ Glob ☐ Flocks ☐ None

IDEM 03/14/13

Attachment 7. IDEM OWQ Biological Qualitative Habitat Evaluation Index (front).

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

Sample # | bioSample # | Stream Name | Location

Surveyor | Sample Date | County | Macro Sample Type | ☐ Habitat Complete | QHEI Score:

1] *SUBSTRATE* Check ONLY Two predominant substrate TYPE BOXES; estimate % and check every type present

BEST TYPES

PREDOMINANT P/G	R/R	PRESENT P/G	R/R	TOTAL %
☐	☐	☐	☐	____ BLDR/SLABS [10]
☐	☐	☐	☐	____ BOULDER [9]
☐	☐	☐	☐	____ COBBLE [8]
☐	☐	☐	☐	____ GRAVEL [7]
☐	☐	☐	☐	____ SAND [6]
☐	☐	☐	☐	____ BEDROCK [5]

OTHER TYPES

PREDOMINANT P/G	R/R	PRESENT P/G	R/R	TOTAL %
☐	☐	☐	☐	____ HARDPAN [4]
☐	☐	☐	☐	____ DETRITUS [3]
☐	☐	☐	☐	____ MUCK [2]
☐	☐	☐	☐	____ SILT [2]
☐	☐	☐	☐	____ ARTIFICIAL [0]

(Score natural substrates; ignore sludge from point-sources)

NUMBER OF BEST TYPES: ☐ 4 or more [2] ☐ 3 or less [0]

ORIGIN (Check ONE (Or 2 & average))

☐ LIMESTONE [1]
☐ TILLS [1]
☐ WETLANDS [0]
☐ HARDPAN [0]
☐ SANDSTONE [0]
☐ RIP/RAP [0]
☐ LACUSTRINE [0]
☐ SHALE [-1]
☐ COAL FINES [-2]

QUALITY

SILT
☐ HEAVY [-2]
☐ MODERATE [-1]
☐ NORMAL [0]
☐ FREE [1]

EMBEDDEDNESS
☐ EXTENSIVE [-2]
☐ MODERATE [-1]
☐ NORMAL [0]
☐ NONE [1]

Substrate Maximum 20

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3 and estimate percent: **0**–Absent; **1**–Very small amounts or if more common of marginal quality; **2**-Moderate amounts, but not of highest quality or in small amounts of highest quality; **3**-Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)

% Amount		% Amount		% Amount	
___ __	UNDERCUT BANKS [1]	___ __	POOLS > 70cm [2]	___ __	OXBOWS, BACKWATERS [1]
___ __	OVERHANGING VEGETATION [1]	___ __	ROOTWADS [1]	___ __	AQUATIC MACROPHYTES [1]
___ __	SHALLOWS (IN SLOW WATER) [1]	___ __	BOULDERS [1]	___ __	LOGS OR WOODY DEBRIS [1]
___ __	ROOTMATS [1]				

AMOUNT (Check ONE (Or 2 & average))

☐ EXTENSIVE > 75% [11]
☐ MODERATE 25 - 75% [7]
☐ SPARSE 5 - < 25% [3]
☐ NEARLY ABSENT < 5% [1]

Cover Maximum 20

Comments

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY
☐ HIGH [4]
☐ MODERATE [3]
☐ LOW [2]
☐ NONE [1]

DEVELOPMENT
☐ EXCELLENT [7]
☐ GOOD [5]
☐ FAIR [3]
☐ POOR [1]

CHANNELIZATION
☐ NONE [6]
☐ RECOVERED [4]
☐ RECOVERING [3]
☐ RECENT OR NO RECOVERY [1]

STABILITY
☐ HIGH [3]
☐ MODERATE [2]
☐ LOW [1]

Channel Maximum 20

Comments

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

L	R	EROSION
☐	☐	NONE/LITTLE [3]
☐	☐	MODERATE [2]
☐	☐	HEAVY/SEVERE [1]

L	R	RIPARIAN WIDTH
☐	☐	WIDE > 50m [4]
☐	☐	MODERATE 10-50m [3]
☐	☐	NARROW 5-10m [2]
☐	☐	VERY NARROW [1]
☐	☐	NONE [0]

L	R	FLOOD PLAIN QUALITY
☐	☐	FOREST, SWAMP [3]
☐	☐	SHRUB OR OLD FIELD [2]
☐	☐	RESIDENTIAL, PARK, NEW FIELD [1]
☐	☐	FENCED PASTURE [1]
☐	☐	OPEN PASTURE, ROW CROP [0]

L	R	
☐	☐	CONSERVATION TILLAGE [1]
☐	☐	URBAN OR INDUSTRIAL [0]
☐	☐	MINING/CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10

Comments

5] *POOL/GLIDE AND RIFFLE/RUN QUALITY*

MAXIMUM DEPTH (Check ONE (ONLY!))
☐ > 1m [6]
☐ 0.7 - < 1m [4]
☐ 0.4 - < 0.7m [2]
☐ 0.2 - < 0.4m [1]
☐ < 0.2m [0] [metric = 0]

CHANNEL WIDTH (Check ONE (Or 2 & average))
☐ POOL WIDTH > RIFFLE WIDTH [2]
☐ POOL WIDTH = RIFFLE WIDTH [1]
☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY (Check ALL that apply)
☐ TORRENTIAL [-1]
☐ VERY FAST [1]
☐ FAST [1]
☐ MODERATE [1]
☐ SLOW [1]
☐ INTERSTITIAL [-1]
☐ INTERMITTENT [-2]
☐ EDDIES [1]

Indicate for reach – pools and riffles.

Recreation Potential (Circle one and comment on back)
☐ Primary Contact
☐ Secondary Contact

Pool/ Current Maximum 12

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

☐ NO RIFFLE [metric = 0]

RIFFLE DEPTH
☐ BEST AREAS > 10cm [2]
☐ BEST AREAS 5 - 10cm [1]
☐ BEST AREAS < 5cm [metric = 0]

RUN DEPTH
☐ MAXIMUM > 50cm [2]
☐ MAXIMUM < 50cm [1]

RIFFLE/RUN SUBSTRATE (Check ONE (Or 2 & average))
☐ STABLE (e.g., Cobble, Boulder) [2]
☐ MOD. STABLE (e.g., Large Gravel) [1]
☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
☐ NONE [2]
☐ LOW [1]
☐ MODERATE [0]
☐ EXTENSIVE [-1]

Riffle/ Run Maximum 8

Comments

6] *GRADIENT* (ft/mi)

DRAINAGE AREA (mi²)

☐ VERY LOW - LOW [2 – 4]
☐ MODERATE [6 - 10]
☐ HIGH - VERY HIGH [10 - 6]

%POOL: ____ %GLIDE: ____
%RUN: ____ %RIFFLE: ____

Gradient Maximum 10

IDEM 11/15/12

Attachment 7 (continued). IDEM OWQ Biological QHEI (back).

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

COMMENT _____

A-CANOPY
- ☐ > 85% - Open
- ☐ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

B-AESTHETICS
- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSOs/SSOs/Outfalls

C-RECREATION

Area Depth
Pool: ☐ > 100 ft² ☐ > 3 ft

D-MAINTENANCE
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag: ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H_2O ☐ Tile ☐ H_2O Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition
- ☐ Agriculture ☐ Livestock

Looking upstream (> 10m, 3 readings; ≤ 10m, 1 reading in middle); Round to the nearest whole percent

	Right	Middle	Left	Total Average
% open	____ %	____ %	____ %	____ %
	X	X	X	

Stream Drawing:

IDEM 11/15/12

Attachment 8. IDEM OWQ Chain of Custody Form.

Indiana Department of Environmental Management

OWQ Chain of Custody Form

Project:
OWQ Sample Set or Trip #:

I Certify that the sample(s) listed below was/were collected by me, or in my presence. Date:_____

Signature:_____ Section:_____

Sample Media (☐ Water, ☐ Algae,☐ Fish, ☐ Macro, ☐ Cyanobacteria/Microcystin, ☐ Sediment)

Lab Assigned Number / Event ID	IDEM Control Number	Sample Type	ID	1000 ml P.N.M.	1000 ml G.N.M.	40 ml Vial	120 ml P (Bact)	2000 ml Nalgene	250 ml Nalgene	125 ml Glass	Date and Time Collected		One check per bottle present
											Date	Time	

P = Plastic	G = Glass	N.M. = Narrow Mouth	Bact = Bacteriological Only	Should samples be iced?	Y	N
M = MS/MSD	B = Blank	D = Duplicate	R = Revisit			

Carriers

I certify that I have received the above sample(s).

Signature	Date	Time	Seals Intact		Comments
Relinquished By:			Y	N	
Received By:					
Relinquished By:			Y	N	
Received By:					
Relinquished By:			Y	N	
Received By:					
IDEM Storage Room #					

Lab Custodian

I certify that I have received the above sample(s), which has/have been recorded in the official record book. The same sample(s) will be in the custody of competent laboratory personnel at all times, or locked in a secured area.

Signature:_____ Date:_____ Time:_____

Lab:_____ Address:_____

Revision Date: 4/27/2016

Attachment 9. 2016 Corvallis Water Sample Analysis Request Form.

Indiana Department of Environmental Management
Office of Water Quality
Watershed Planning and Assessment Branch
www.idem.IN.gov

Water Sample Analysis Request

Project Name: 2016 Corvallis **Composite** ☐ **Grab** ☒

OWQ Sample Set	16WQW	IDEM Sample Nos.	
Crew Chief		Lab Sample Nos.	
Collection Date	Apr. - Oct.	Lab Delivery Date	

Anions and Physical Parameters

Parameter	Test Method	Total	Dissolved
Alkalinity	310.2	☒ **	☐
Total Solids	SM2540B	☒ **	
Suspended Solids	SM2540D	☒ **	
Dissolved Solids	SM2540C		☒ **
Sulfate	300.0	☐ **	☒ **
Chloride	300.0	☐ **	☒
Hardness (Calculated)	SM-2340B	☒ **	☐
Fluoride	SM4500-F-C	☐ **	☐

Priority Pollutant Metals Water Parameters

Parameter	Test Method	Total	Dissolved
Antimony	200.8	☒	☒
Arsenic	200.8	☒	☒
Beryllium	200.8	☐	☐
Cadmium	200.8	☒	☒
Chromium	200.7	☒	☒
Copper	200.8	☒	☒
Lead	200.8	☒	☒
Mercury, Low Level	1631, Rev E.	☐	☐
Nickel	200.8	☒	☒
Selenium	200.8	☒	☒
Silver	200.8	☒	☒
Thallium	200.8	☐	☐
Zinc	200.7	☒	☒

Cations and Secondary Metals Parameters

Parameter	Test Method	Total	Dissolved
Aluminum	**200.7**, 200.8	☒	☒
Barium	200.8	☐	☐
Boron	200.8	☐	☐
Calcium	**200.7**, 200.8	☒ ***	☐
Cobalt	200.8	☐	☐
Iron	200.7	☐	☐
Magnesium	**200.7**, 200.8	☒ ***	☐
Manganese	200.8	☐	☐
Sodium	200.7	☐	☐
Silica, Total Reactive	200.7	☐	☐
Strontium	200.8	☐	☐

Send reports (Fed. Ex. or UPS) to:
Tim Bowren - IDEM
STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219

Deliver reports to:
Tim Bowren – IDEM
STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219

Organic Water Parameters

Parameter	Test Method	Total
Priority Pollutants: Oranochlorine Pesticides and PCBs	608	☐
Priority Pollutants: VOCs - Purgeable Organics	624	☐
Priority Pollutants: Base/Neutral Extractables	625	☐
Priority Pollutants: Acid Extractables	625	☐
Phenolics, 4AAP	420.4	☐
Oil and Grease, Total	1664A	☐

Nutrient & Organic Water Chemistry Parameters

Parameter	Test Method	Total	Dissolved
Ammonia Nitrogen	SM4500NH3-G	☒	☐
$CBOD_5$	SM5210B	☐	
Total Kjeldahl Nitrogen (TKN)	SM4500N(Org)	☒	☐
Nitrate + Nitrite	353.2	☒	☐
Total Phosphorus	365.1	☒	☐
TOC	SM 5310C	☒	☐
COD	410.4	☒	☐
Cyanide (Total)	335.4	☒	☐
Cyanide (Free)	SM4500CN-I	☒ *	☐
Cyanide (Amenable)	SM4500CN-G	☐ *	☐
Sulfide, Total	376.2	☐	☐

RFP 12-48 Contract Number:	A305-3-1 (Pace-Indy) PO # 0014561536 (Pace-Indy)

30 day reporting time required.

Notes:
** **= DO NOT RUN PARAMETER IF SAMPLE IDENTIFIED AS A BLANK ON THE CHAIN OF CUSTODY**
* **= RUN ONLY IF TOTAL CYANIDE IS DETECTED**
*** = *Report Calcium, Magnesium as Total Hardness components*

Testing Laboratory: Pace Analytical Services, Inc.
Attn: Sue Brotherton
Phone: 317-228-3136 7726 Moller Road
Indianapolis, IN 46268

Appendix 1. List of IDEM Documents and SOPs used in the development of the 2016 Lower Wabash River Probabilistic Monitoring Program Sampling and Analysis Workplan.

Indiana Department of Environmental Management (IDEM). 1992, revision 1. Section 2, Biological Studies Section Hazards Communications Manual (List of Contents). Pages 74 – 91 *in* IDEM. 1992. Biological Studies Section Standard Operating Procedures Manual (SOP). Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 1992, revision 1. Section 3, Quality Assurance Project Plan, Development of Biological Criteria (Fish) for the Ecoregions of Indiana. Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 1992, revision 1. Section 4, Standard Operating Procedures for Fish Collections, Use of Seines, Electrofishers, and Sample Processing. Pages 496 – 534 *in* IDEM. 1992. Biological Studies Section Standard Operating Procedures Manual (SOP). Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 1992, revision 1. Section 5, Standard Operating Procedures for Conducting Rapid Assessment of Ambient Water Quality Using Fish (RBP-V). Pages 535 – 663 *in* IDEM. 1992. Biological Studies Section Standard Operating Procedures Manual (SOP). Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana

IDEM. 1992, revision 1. Section 11, Standard Operating Procedures-Appendices of Operational Equipment Manuals and Procedures. Page 1386 – 3313 *in* IDEM. 1992. Biological Studies Section Standard Operating Procedures Manual (SOP). Biological Studies Section, Surveillance and Standards Branch, Office of Water Management, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 1997. Water Quality Surveys Section Laboratory and Field Hazard Communication Plan Supplement. IDEM 032/02/018/1998, Revised October 1998. Assessment Branch, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2002. Water Quality Surveys Section Field Procedure Manual, Assessment Branch, Indiana Department of Environmental Management, Indianapolis, Indiana. Located at https://extranet.idem.in.gov/standards/docs/quality_improvement/qapps/owq_surveys_section_field_manual.pdf

IDEM. 2004. Quality Assurance Project Plan (QAPP) for Indiana Surface Water Quality Monitoring and Total Maximum Daily Load (TMDL) Program, (Rev. 3, Oct. 2004). Located at the IDEM OWQ WAPB offices (100 North Senate Avenue, Indianapolis, IN 46204-2251).

IDEM. 2008. IDEM Personal Protective Equipment Policy, revised May 1 2008. A-059-OEA-08-P-R0. Office of External Affairs, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2010. Multi-habitat (MHAB) Macroinvertebrate Collection Procedure Technical Standard Operating Procedure. S-001-OWQ-W-BS-10-T-R0. Office of Water Quality, Watershed Planning and Assessment Branch, Biological Studies Section. Indianapolis, Indiana. Located at https://extranet.idem.in.gov/standards/docs/sops/owq/S-001-OWQ-W-BS-10-S-R0.pdf

IDEM. 2010. IDEM Health and Safety Training Policy, revised October 1 2010. A-030-OEA-10-P-R2.Office of External Affairs, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2010. IDEM Injury and Illness Resulting from Occupational Exposure Policy, revised October 1 2010. A-034-OEA-10-P-R2. Office of External Affairs, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2011. DRAFT Indiana Water Quality Monitoring Strategy 2011-2019. B-001-OWQ-W-00-11-R0. Watershed Assessment and Planning Branch, Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2012. IDEM Agency Wide Quality Management Plan. IDEM, Indiana Government Center North, 100 N. Senate Ave., Indianapolis, Indiana, 46204. Available at http://www.in.gov/idem/files/idem_qmp_2012.pdf

IDEM. 2014. DRAFT Indiana Integrated Water Monitoring and Assessment Report 2014. Edited by Jody Arthur. Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2014. DRAFT Indiana's 2014 Consolidated Assessment and Listing Methodology (CALM) Revised. Edited by Jody Arthur. Office of Water Quality, Indiana Department of Environmental Management, Indianapolis, Indiana.

IDEM. 2015a. Processing and Identification of Diatom Samples. B-002-OWQ-WAP-TGM-15-T-R0. Office of Water Quality, Watershed Assessment and Planning Branch. Indianapolis, Indiana. Located at https://extranet.idem.in.gov/standards/docs/sops/owq/B-002-OWQ-WAP-TGM-15-T-R0.pdf

IDEM. 2015b. Global Positioning System (GPS) Data Creation Technical Standard Operating Procedure. B-001-OWQ-WAP-XXX-15-T-R0. Office of Water Quality, Watershed Assessment and Planning Branch. Indianapolis, Indiana. Located at https://extranet.idem.in.gov/standards/docs/sops/owq/B-001-OWQ-WAP-XXX-15-T-R0.pdf

IDEM. 2016. Phytoplankton and Periphyton Field Collection Procedures. B-004-OWQ-WAP-XX-16-T-R0. Office of Water Quality, Watershed Assessment and Planning Branch. Indianapolis, Indiana. Located at https://extranet.idem.in.gov/standards/docs/sops/owq/B-004-OWQ-WAP-XX-16-T-R0.pdf

Appendix 2. Pace Laboratory Inc., Indianapolis: Accreditation Documents

Indiana State Department of Health
An Equal Opportunity Employer

Michael R. Pence
Governor

Jerome M. Adams, MD, MPH
State Health Commissioner

CERTIFIED MAIL NO. 7000 0520 0012 9325 6837
RETURN RECEIPT REQUESTED

May 6, 2015

Beth Schrage
Pace Analytical Services, Inc.
7726 Moller Road
Indianapolis, Indiana 46268

Dear Ms. Schrage:

On April 22, 2015, Philip Zillinger, Chemistry Laboratory Certification Officer, Chemistry Laboratory, ISDH Laboratories, Indiana State Department of Health (ISDH), visited the laboratory of the Pace Analytical Services, Inc., 7726 Moller Road, Indianapolis, to conduct an on-site evaluation. The laboratory was evaluated for purposes of determining the laboratory's capabilities for analyzing samples for metals, cyanide, fluoride, nitrate, nitrite, volatile organic compound (VOC) and trihalomethane (THM) content pursuant to the National Primary Drinking Water Regulations (NPDWR) as implemented by 40 CFR Part 141 and the Indiana Primary Drinking Water Regulations (IPDWR) as implemented by 327 IAC 8-1 and 8-2.

Based on the information contained in the attached evaluation report, the recommendation of the survey officer, and the performance evaluation sample results, the ISDH hereby issues the following determination, pursuant to IC 4-21.5-3-5:

- The laboratory is hereby granted full certification for: *antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, thallium, copper, lead, nitrate, nitrite, the regulated volatile organic compounds (VOC), vinyl chloride and trihalomethanes (THM).*

- This certification is valid for three (3) years from the date of this letter, with continuing successful performance on performance evaluation samples.

- The laboratory has been assigned laboratory number C-49-06. This number is to be used on all reports used for compliance monitoring of public water supplies.

Indiana
A State that Works

2 North Meridian Street • Indianapolis, IN 46204
317.233.1325 tdd 317.233.5577
www.statehealth.in.gov

To promote and provide essential public health services.

Appendix 2. Pace Laboratory Inc., Indianapolis: Accreditation Documents (continued)

If you wish to seek review or stay of the effectiveness of this determination, pursuant to IC 4-21.5-3-7, you are required to submit, in writing, a petition, on or before May 25, 2015, to:

Office of the Secretary
Indiana State Department of Health
2 North Meridian Street
Indianapolis, Indiana 46204-3006

The petition for review or stay must include facts demonstrating that:

- The petitioner is a person to whom the determination is specifically directed;
- The petitioner is aggrieved or adversely affected by the agency determination; or,
- The petitioner is entitled to review under any law.

Dated at Indianapolis, Indiana, this 6th day of May, 2015.

Sincerely,

Judith C Lovchik

Judith C. Lovchik, PhD, D(ABMM)
Assistant Commissioner, Public Health Protection and Laboratory Services
Indiana State Department of Health
550 West 16th Street
Indianapolis, Indiana 46202
317 921-5808

A copy of this letter was sent on the above date, postage prepaid first class mail, to:

Matthew Prater
Indiana Department of Environmental Management
Drinking Water Branch
100 North Senate Avenue
Indianapolis, IN 46204

Appendix 2. Pace Laboratory Inc., Indianapolis: Accreditation Documents (continued)

Indiana State Department of Health

SCOPE OF CERTIFICATION
PACE ANALYTICAL SERVICES, INC.
INDIANAPOLIS, INDIANA

ANALYTE	METHOD	ANALYTE	METHOD
METALS		PCB	
Antimony	EPA 200.8R5.4	as decachlorobiphenyl	Not certified
Arsenic	EPA 200.8R5.4		
Barium	EPA 200.7R4.4; EPA 200.8R5.4	VOC	
Beryllium	EPA 200.7R4.4; EPA 200.8R5.4	20 regulated VOC	EPA 524.2R4.1
Cadmium	EPA 200.7R4.4; EPA 200.8R5.4	Vinyl chloride	EPA 524.2R4.1
Chromium	EPA 200.7R4.4; EPA 200.8R5.4	DBCP	Not certified
Copper	EPA 200.7R4.4; EPA 200.8R5.4	EDB	Not certified
Lead	EPA 200.8R5.4		
Mercury	EPA 245.1R3.0	TTHM	
Nickel	EPA 200.7R4.4; EPA 200.8R5.4	4 THM	EPA 524.2R4.1
Selenium	EPA 200.8R5.4		
Thallium	EPA 200.8R5.4	PAH	
		Benzo(a)pyrene	Not certified
NONMETALS			
Cyanide	EPA 335.4R1.0	ADIPATE/PHTHALATE	
Fluoride	EPA 300.0R2.1	Di(2-ethylhexyl)adipate	Not certified
Nitrate	EPA 300.0R2.1	Di(2-ethylhexyl)phthalate	Not certified
Nitrite	EPA 300.0R2.1		
		CARBAMATES	
PESTICIDES		Carbofuran	Not certified
Alachlor	Not certified	Oxamyl (vydate)	Not certified
Atrazine	Not certified		
Chlordane	Not certified	HERBICIDES	
Endrin	Not certified	2,4-D	Not certified
Heptachlor	Not certified	2,4,5-TP (silvex)	Not certified
Heptachlor epoxide	Not certified	Dalapon	Not certified
Hexachlorobenzene	Not certified	Dinoseb	Not certified
Hexachlorocyclopentadiene	Not certified	Diquat	Not certified
Lindane	Not certified	Endothall	Not certified
Methoxychlor	Not certified	Glyphosate	Not certified
Simazine	Not certified	Pentachlorophenol	Not certified
Toxaphene	Not certified	Picloram	Not certified

Appendix 2. Pace Laboratory Inc., Indianapolis: Accreditation Documents (continued)

Indiana State Department of Health

SCOPE OF CERTIFICATION
PACE ANALYTICAL SERVICES, INC.
INDIANAPOLIS, INDIANA

ANALYTE	METHOD	ANALYTE	METHOD
DISINFECTION BYPRODUCTS		MISCELLANEOUS ANALYTES	
HAA5	Not certified	2,3,7,8-TCDD (dioxin)	Not certified
Bromate	Not certified	Asbestos	Not certified
Chlorite	Not certified		